Last Year's Progress and This Year's Plans—*Electrical Science, Engineering and Business for 1915 Summarized in Special Contributions as a Basis for Plans for 1916*

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Electrical World

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Electrical World

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On the Threshold of 1916

IN keeping with the season when every branch of the industry is perfecting plans for the activities of 1916, the ELECTRICAL WORLD presents its annual review for the year just passed as a basis for the plans of the new year. The year 1915 may be conceived broadly as an inventory-taking period on a tremendous scale throughout the industry. Attention was given not so much to expansion and extension as to the more intensive development of the resources in finance, in applied engineering and in manufacturing.

The industry is entering a period of very great activity, reflected for the last three or four months in several branches but now being felt throughout the field. Because of these conditions it is believed that individual readers, whether engineers, business executives or other men of the industry, will find the articles in these pages particularly interesting and stimulating.

Naturally the great war is reflected by the authors of the financial, commercial and engineering reviews. The United States is taking a new place among the nations, and, as Charles A. Stone points out in his article, this means new responsibilities for the country and particularly for the electrical industry. How these tendencies in foreign trade may affect the individual business is emphasized by Maurice Coster. In the field of engineering the war has given the engineer a new conception of his personal responsibilities, as indicated by Frank J. Sprague. There is no doubt that the Naval Consulting Board inaugurates a movement for the recognition of the engineer's contribution to society which will be manifest not only in the coming year but for many years thereafter.

T. C. Martin's statistical discussion on the year's business calls particular attention to the general conditions. A very practical consideration in the year's plans is the cost of doing business. Edward N. Hurley adds a note of governmental suggestion to this consideration. Another internal subject of most practical significance is the crystallization of principles in commission regulation of public utilities, and William J. Hagenah presents the developments of the year in a way that analyzes the tendencies of the times.

IN the field of applied science our reviews are contributed by engineers notably qualified to discuss the subjects treated. They touch the special achievements of the year in radio communication, the superconduction of metals, and investigation of crystalline atomic structures. The developments in the design and construction of power-station equipment present certain features, particularly in the direction of mechanical design, and the year has been marked by the installation of very large generating units and transformers. In the power-generation field larger units, high steam pressures and greater output per square foot of heating surface in boilers should be noted. In the transmission of electric energy no unusual tendencies are marked.

Out of the war has arisen a popular impression of American electrochemistry which is erroneous. As is pointed out in our review, economic conditions control the commercial development of our chemical industries and the American chemist has done and is now doing his duty.

In illumination the wonderful Panama-Pacific International Exposition called attention once more to the striking possibilities of electric lighting, and following the beautiful exhibition of flood-lighting there has been a very decided trend toward this spectacular application. In the more utilitarian developments we are moving steadily in the direction of better and more lighting because of the relatively high efficiency of our present light sources. Both domestic and industrial electric heating have had a new impetus. This branch for the coming year calls for investigations both in applied engineering and commercial rate problems.

CONSTRUCTIVE suggestions for association activities in the year to come and a general attitude of optimism are expressed in the articles contributed by the executives of the associations and societies. No industry has within it a better basis for co-operative and concerted effort than ours. It is generally conceded, however, that there is some duplication of effort which should be avoided and that the opportunity exists for combining under some plan by which all groups may present a united front. Steps have been taken in this direction, and it is anticipated that the year to come will see other developments in a more definite co-operation, if not closer amalgamation of local and national associations and societies.

In the large future of this country the electrical industry is destined to occupy a leading and honored place. The great opportunities which are within its grasp call for business planning of a high order, for technical and scientific mobilization of resources, for constructive statesmanship both in the centers of finance and the legislative halls of the country, and for a patriotic determined co-operation which shall surpass any ever before known.

Season Peak Load of New York Systems Reaches Record Total of 242,166 Kw.

Representing an increase of 12,379 kw. over the preceding year's record peak load, the season peak of the combined systems of the New York Edison and United Electric Light & Power companies was passed shortly after 5 p.m. on Dec. 6, when the total load reached a maximum of 242,166 kw. Of this load, 196,866 kw. was carried by the lines of the New York Edison Company and 45,300 kw. by the lines of the United company. Attributable, doubtless, to the early - shopping movement and to the advanced date at which holiday illuminations were begun by New York merchants, the 1915 peak came seventeen days earlier than that of the preceding year, 1914, when the maximum swing of the station wattmeters was recorded on Dec. 23. The accompanying illustration is from an unretouched photograph of lower Manhattan taken from the 750-ft. Woolworth Building, and shows a characteristic winter's evening illumination of the city's business district when office lamps are lighted after early nightfall.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Pan-American Scientific Congress

The second Pan-American Scientific Congress convened in Washington, D. C., Dec. 27 and will remain in session to Jan. 8. Three general sessions have been provided for, one of which took place on Dec. 27. The second will take place on Jan. 1 and the third on Jan. 8. The sessions of the other days will be devoted to the sections and sub-sections. All sessions of the congress are held in the Memorial Continental Hall.

The first Pan-American Scientific Congress was held in Santiago, Chile, 1908. When it adjourned it voted unanimously to hold the second congress in Washington. There are in attendance approximately 100 official delegates from the twenty-one American republics and sixty by special invitation or representing societies, universities, etc. Aside from these official representatives there are also in attendance approximately 1000 unofficial delegates and members.

At the first general session the speakers in their addresses referred only incidentally to science. Pan-Americanism was their theme, and following the lead of Secretary of State Lansing, who greeted the congress in his official capacity, representatives from the Southern republics asserted that the Americas were united for progress and would, if occasion came, be united politically for defense. Vice-president Marshall welcomed the delegates on behalf of this government in place of President Wilson.

The government has planned to give the gathering as official a setting as possible. While the congress itself is largely unofficial and ten other private associations are meeting in conjunction with its sessions, nearly all of the chairmen of the technical sections into which the general congress resolved itself are officials of technical bureaus in the Departments of War, Navy and Agriculture and other departments. The objects of the congress were well epitomized by Secretary Lansing in his address, in which he said: "Commerce and industry, science and art, public and private law, government and education, all those great fields which invite the intellectual thought of man fall within the province of the deliberations of this congress. In the exchange of ideas, in comparison of experiences, we shall come to know one another and to carry to the nations which we represent a better and truer knowledge of our neighbors than we have had in the past. I believe that from that wider knowledge a mutual esteem and trust will spring which will unite these republics more closely politically, commercially and intellectually and give to the Pan-American spirit an impulse and power which it has never known before."

Section V of the congress, which is devoted to engineering, is presided over by Brig.-Gen. W. H. Bixby. J. B. Whitehead is chairman of Sub-section 3, which is devoted to electrical engineering. The official representatives of the American Institute of Electrical Engineers are J. B. Whitehead, J. H. Finney, F. L. Hutchinson and Percy H. Thomas. The complete list of papers scheduled for presentation before the electrical sub-section is as follows:

Dec. 29—"Electrochemical Industries," by G. A. Roush; "Present Status of Water-Power," by H. W. Buck; "Industrial Applications of Electricity," by Philip Torchio; "Hydroelectric Utilization at Niagara and Elsewhere," by Maurice Deutsch.

Jan. 3—"Electric Power Transmission and Distribution Systems," by Percy H. Thomas; "Aluminum Conductors for Electric Transmission Lines," by Theodore Varney; "Underground Cables," by H. W. Fisher; "Electrification of Transportation Lines," by N. W. Storer.

Jan. 4—"Recent Telegraph and Telephone Development," by F. B. Jewett; "Electrical Codes and Standards," by Edward B. Rosa.

On Tuesday evening, Jan. 4, there will be a reception by the trustees of the Carnegie Institution. On Thursday evening, Jan. 6, there will be an address by the President of the United States, and on Friday evening he will give a reception at the White House.

Decision in Refillable-Fuse Controversy

Report of the Bureau of Standards in the Case of the Economy Fuse & Manufacturing Company Versus the Underwriters' Laboratories, Inc., Etc., Concerning the Fire and Accident Hazard of the Economy Refillable Fuse

There exists a permanent arrangement between the Underwriters' Laboratories, Inc., of Chicago, Ill., and the Bureau of Standards whereby in the event of dispute between the Underwriters' Laboratories and the manufacturer of any device submitted to them for approval the dispute may, with the consent of both parties, be submitted to the Bureau of Standards for decision.

In accordance with this arrangement, the Underwriters' Laboratories and the Economy Fuse & Manufacturing Company of Chicago, Ill., jointly appealed, under date of May 17, 1915, to the Bureau of Standards for decision on the following question:

"Has it been shown that the use of the fuses manufactured by the Economy Fuse & Manufacturing Company results in no greater fire or accident hazard than the use of other cartridge inclosed fuses at present listed as standard by Underwriters' Laboratories, Inc.?"

It was originally agreed that all of the evidence in the case must be presented not later than July 23, 1915—fifteen days after the formal hearing held at the bureau on July 8. This date was later changed to Oct. 15, at the formal request of the manufacturers of approved fuses, in order that they might have more opportunity to secure and present to the Bureau of Standards additional evidence bearing on the case.

At the outset of the investigation of this question a considerable amount of evidence was submitted to the bureau by both the Underwriters' Laboratories and the Economy Fuse & Manufacturing Company. On July 8, 1915, a public hearing was held at the offices of the Bureau of Standards, when evidence and arguments were presented by representatives of the Underwriters' Laboratories, the Economy Fuse & Manufacturing Company, and by a number of companies manufacturing standard inclosed fuses.

In addition to the evidence presented at the hearing, the Bureau of Standards made many tests of fuses, some in its own laboratories and others at large power plants in other cities. A majority of these tests were made in accordance with the specifications of the Underwriters' Laboratories, but a considerable number were made under other conditions prescribed by the bureau or suggested by fuse manufacturers.

The chief objects of these tests were to determine the relative performance on heavy overloads of new and refilled Economy fuses and standard inclosed cartridge fuses as supplied by manufacturers or by jobbers, and further to determine to what extent the performance of such fuses might be deleteriously affected by protracted service under normal conditions in customers' cut-outs.

A great deal of attention has also been given to the question of the actual use of Economy and of approved fuses, and the experience of a great many users of fuses was obtained by correspondence and by inspectors of the Bureau of Standards, who personally visited a great many installations where fuses of approved makes as well as fuses of the Economy company were in use. Special attention was given to the possibilities of the dangerous misuse and the extent of observed misuse both of Economy fuses and of approved types of inclosed cartridge fuses.

The question was carefully considered in its various aspects by a committee of technical experts of the Bureau of Standards and has been decided on the technical questions at issue.

The report of the bureau gives first, in about twenty-five typewritten pages, a summary of the evidence submitted and the investigation made by the bureau. This is followed by a brief statement of the conclusion and finding, as follows:

CONCLUSION

"It appears from the foregoing résumé of the bureau's investigation that the Economy fuse, when new and properly filled or refilled, operates satisfactorily under the most common working conditions of overload and moderate short-circuits when in circuits with low inductance, and possesses some marked advantages over the approved fuses with which it has been compared. This fuse is, however, distinctly inferior to most of these approved fuses under severe short-circuit conditions. It has not yet been established that it will not introduce hazards peculiar to refillable fuses, owing to deterioration from repeated blowing of the fuse elements in the same casing and possibly from long-continued subjection of the fuse to the working current. The approval of the present type of Economy fuse for unrestricted use would therefore result in a lowering of the standard of fuse performance under severe test conditions, and might introduce hazards in actual use the importance of which it is difficult to estimate at this time. The experience with the present type has not yet been sufficient to determine whether the total hazard is greater or less than it is with approved fuses as they are actually used in practice. The investigation therefore leads to the following finding:

FINDING

"It has not been shown that the use of the fuses manufactured by the Economy Fuse & Manufacturing Company will result in no greater fire or accident hazard than the use of inclosed Underwriters' Laboratories, Inc.

"On the other hand, the evidence in the case does not show that the use of Economy fuses has on the whole resulted in any greater fire or accident hazard than is involved in the use of standard inclosed cartridge fuses.

"In comparison with fuses listed as standard by Underwriters' Laboratories, the fuses at present manufactured by the Economy Fuse & Manufacturing Company have been shown to possess certain features which tend to increase the hazards involved in the use of fuses and other features which tend to reduce such hazards. The relative importance of these features can be determined only by extended experience under working conditions.

"It is therefore recommended that Economy fuses be not approved at present for general use on the same basis as fuses now listed as standard by the Underwriters' Laboratories, Inc., but that a continuation and extension of their use be permitted by municipal and underwriters' inspection departments under conditions where their performance can be observed by each in-

spection department until sufficient experience regarding their performance under service conditions can be obtained to justify an unqualified approval or refusal to approve."

The evidence on which the foregoing decision was reached is reported and discussed in the eight sections of the report, which together occupy about 525 typewritten pages. It is expected that the use of the Economy fuses will be sanctioned by municipal and underwriters' inspection departments under such conditions as to answer definitely by experience some of the questions on which further information is needed, so that an unqualified approval or disapproval may be given in the near future.

Snowstorm Ties Up Middle West

A heavy snowstorm swept up from the South on Wednesday through parts of the Middle West and over Pennsylvania, western New York and the lake region. The worst effects of the storm, according to the Weather Bureau at Chicago, were felt in Ohio and Kentucky, where the snow, borne along by a gale, blocked all traffic and brought down large numbers of wires.

Cleveland experienced the worst storm in two years. The sleet which preceded the snowstorm did considerable damage to telephone, telegraph and transmission systems. Officials of the telephone and telegraph systems report more wires down than has been the case for many years.

At Indianapolis, Ind., the rain, sleet and snow, accompanied by the high wind, brought down wires and poles throughout the city and suburbs.

Reports from western Kentucky and adjacent parts of Ohio told of much damage by high wind and sleet, especially in breaking wires and telephone and telegraph poles.

Messages from Chicago stated that the city had escaped the storm and that the sun was shining brightly all day.

A blinding snowstorm swept over the lake region, covering western New York with a blanket of snow from 10 in. to 12 in. deep on the level. High winds, however, piled the snow in drifts from 5 ft. to 7 ft. deep, blocking traffic and threatening, according to last reports, to tie up railroad, telegraph, telephone and transmission facilities.

All traffic was held up in Buffalo, where over a foot of snow fell. Twenty inches of snow fell in Troy, and over three and a half feet lay on the ground in outlying districts. The fury of the storm was so great in Rochester that it was feared the city would be isolated from the world. Considerable snow fell at Gloversville, and at Interlaken the storm was said to be the worst since 1910.

Throughout Pennsylvania both light and telephone wires are down.

For 40 miles between Christiania and Atolen it was reported that almost every pole was down or leaning dangerously. For 8 miles between Atolen and Gap not a pole was left standing. All poles on the north side of the Harrisburg yards went down, and those on the south side were not considered safe.

Heavy drafts of men and materials were sent east from Pittsburgh to repair miles and miles of telegraph lines carried down by the storm. The Bell Telephone Company has a special train with linemen and engineers working between Pittsburgh and Philadelphia, and the Pennsylvania Railroad has added all available men to the repair service.

The German radio station at Sayville, L. I., now operated by United States naval operators, was out of commission on account of the Atlantic Coast storm. Secretary Daniels of the Navy Department, which is intrusted by executive order of President Wilson with the operation of the station, was notified late this afternoon by the naval officers on duty at Sayville that the station was out of commission temporarily and could neither send nor receive messages from Germany. The report made to Mr. Daniels stated that heavy sleet and high winds had brought down the antennas through which messages are sent and received. The naval officers will endeavor to restore the use of the station promptly.

The storm in the main caused but little damage in New York City and vicinity. A rain, accompanied by a heavy wind, and an occasional flurry of snow were the only inclemencies in the weather. Sleet formed in the morning but not in sufficient quantities to cause any widespread prostration of wires and poles.

Rapid Spread of the Community Christmas-Tree Custom

Begun in a small way only a few years ago, the "community Christmas" tree custom has spread until during the present holidays cities and towns in all parts of the country have been holding neighborhood celebrations, in each of which an electrically lighted outdoor tree was the central feature.

In Greater New York, for example, there were nearly a dozen such local celebrations in different sectons of the

COMMUNITY CHRISTMAS TREE AND PAVILION IN MADISON SQUARE, NEW YORK CITY

city. In several instances impressive services, with singing by choirs and by the assembled spectators, marked the lighting of the trees for the first time on Christmas Eve. This song service, repeated at intervals during the evening and later during Christmas week, was a feature of the Madison Square Park observance—the handsomely illuminated tree and the pavilion erected for the choir being shown in the accompanying illustration. Many suburban towns erected local community Christmas trees, and several staged Christmas pageants with the aid of projector-lantern illumination.

Spread of Workmen's Compensation Laws

During the past year eight commonwealths enacted workmen's compensation legislation, according to the Bureau of Labor Statistics of the United States Department of Labor.

Bulletin No. 185 presents the legislation for the years

1914 and 1915, together with amendments to a number of earlier laws, which in some cases are so extensive as to necessitate the reprinting of the entire law. This bulletin is in effect a supplement to Bulletin No. 126, issued two years ago as a complete compilation up to that date of existing legislation in this field.

The legislation of the year 1914 included three States, Kentucky, Louisiana and Maryland. One of these laws, that of Kentucky, was declared unconstitutional before it came into operation. That of Maryland superseded an earlier statute reported as unworkable. The new laws of 1915 cover eight States, Colorado, Indiana, Maine, Montana, Oklahoma, Pennsylvania, Vermont and Wyoming, besides the Territories of Alaska and Hawaii. The legislation of 1914 included also a presidential order providing a compensation system for employees of the Panama Canal and the Panama Railroad, while that of the current year includes a similar order extending the federal compensation act of 1908 to workmen engaged on or about the government railway in Alaska. With the legislation of these two years, thirty-one States and the Territories of Alaska and Hawaii now have compensation laws. A federal statute covers also about one-fourth of the civilian employees of the United States. All of this legislation has been enacted since 1908, and practically all of the existing legislation in the States since 1910.

Of the new laws of 1914 and 1915, one, that of Wyoming, must be classed as a compulsory insurance law, while those of Maryland and Oklahoma are compulsory compensation laws. In the other States, eight in number, the law permits the employer to elect or reject the compensation act. In case he rejects it, however, he is deprived of the customary defenses under the liability laws.

Ordnance Chief Advocates Electric Plant for Nitrogen Manufacture

Extraction of nitrogen from the air for use in the manufacture of gunpowder and high explosives for the United States Army and Navy is advocated by Brig.-Gen. William M. Crozier, chief of ordnance of the army, in his annual report. General Crozier, who is the ranking expert on ordnance and explosives in the army and who has an international reputation in that respect, is anxious that the United States should do what Germany is now doing—make nitric acid by electrical processes which extract nitrogen from the air, and utilize this acid in the manufacture of explosives.

General Crozier recommends that if means cannot be found to promote the extraction of nitrogen from the air through private enterprise, the government establish factories, using cheap water-power now going to waste. He said: "There are in successful operation in Europe, in several countries, plants for the fixation of atmospheric nitrogen, rendering it available for use in the manufacture of nitric acid. These plants require for their manufacturing processes electrical energy in large amount.

"In order that they may be commercially successful the electricity must be very cheaply obtained, and it is generally thus cheaply obtained by the employment of water-power. In this country the expense of the employment of steam-generated electrical energy would not, in my opinion, be such as to render this method prohibitive for such an amount as would be required for the manufacture of nitric acid for gunpowder and other military explosives.

"I believe that a steam plant could be established which would contribute effectively to the supply of the nitric acid that would be needed in the manufacture of powder for the current prosecution of a considerable war; but the expense, while not prohibitive, would still be such that this kind of plant could probably not maintain itself commercially in ordinary times as against the production of nitric acid from imported nitrates, and the plant would probably be unused during peace.

"Such a solution of the problem would be advisable if no better solution could be found, but the possibility of a better solution is apparent. There are in the United States various opportunities, under the control of the federal government, for the development of great water-power. Some of these, I am informed, are such as to warrant their development for the purpose of power alone, and others would justify development for power in connection with or as an incident to the improvement of navigation. Estimates have been made of the cost of the power which could thus be made available and have shown it to be such as to permit the fixation of atmospheric nitrogen in compounds which could be used in the manufacture of nitric acid at such prices as to enable water-power plants to maintain themselves in successful competition, in the nitrate industry, with foreign sources of supply of nitrates.

"In view of the right of control of the federal government of the sources of water-power, it ought to be possible to promote their development by private parties under such conditions of consent that the government would be assured of their utilization for military purposes, when needed, at a reasonable cost; and as the great bulk of the output of the plants would be for commercial purposes, it would not appear that the government should itself embark in this development and production."

NITROGEN MANUFACTURE IN OTHER COUNTRIES

There are two processes by which nitrogen may be extracted from the air, and both are mentioned by General Crozier in his report. One is the arc process, the other the cyanamide. In Norway the arc process is used, in Germany the cyanamide.

Even before the war such factories were in operation in Europe. The cyanamide plants, or lime nitrogen plants, were used in Germany in the manufacture of fertilizers. At the outbreak of the war there were three plants manufacturing nitrogen in Germany, two in Norway, two in Sweden, one in France, one in Switzerland, two in Italy, one in Austria, one in Japan and one in Canada. These fourteen plants had a total productive capacity of 200,000 tons annually and represented a total investment of $30,000,000. They had $15,000,000 output annually.

In addition to the operations using the cyanamide process when the war began, there were in Norway factories producing nitric acid and fertilizers through utilization of hydroelectric power with the arc process to the extent of over 200,000 hp., with a capital investment of $27,000,000.

The figures given do not take into consideration the cyanamide plants built in Germany since the beginning of the war.

Meeting of National Chamber of Commerce

The fourth annual meeting of the Chamber of Commerce of the United States will be held at the New Willard Hotel, Washington, D. C., on Feb. 8, 9 and 10. It is expected that reports at this meeting will deal with the subjects of permanent tariff commission, national budget, labor exchanges, Federal Trade Commission, commercial arbitration, rural credits, export and import statistics, price maintenance, and the seamen's law. So far as is practicable, reports will be printed in advance and distributed to delegates so that little

time will be necessary for their presentation and full opportunity given for discussion and action.

Among the more important subjects which the chamber will be called upon to consider are national defense, vocational education, employment managers, and the railroads. Foreign-trade problems will occupy at least one whole session, and under this head there will be discussed means of protection against dumping after the war and of safeguarding new industries which have been started in this country during the war to supply our factories with products for which this country has hitherto been dependent on those nations now in arms.

Safety Medal Winners Announced

Winners of the medals awarded by the American Museum of Safety for meritorious work in promoting safety and conserving life have just been announced by Arthur Williams, president of the Museum. The Louis Livingston Seaman medal, for progress and achievement in the promotion of hygiene and the mitigation of occupational disease, is awarded to William Armstrong Fairburn, president of the Diamond Match Company. This medal was awarded last year to Surgeon-General William C. Gorgas, U. S. A.

The *Scientific American* medal, for the most efficient safety device, is awarded to Elmer A. Sperry for his gyroscope compass. The Travelers' Insurance Company's medal this year is awarded to the Hudson & Manhattan Railroad Company for achievement in the prevention of accidents to its own employees and to the public. The medals will be presented to the winners at the annual dinner of the Museum at the Waldorf-Astoria Hotel on Feb. 3.

The Electric Truck in England

Because the English government has commandeered over 50 per cent of the vehicles in the nation it is very difficult to sell any kind of vehicle in England at the present time, let alone electric trucks. This was a statement made by E. W. Curtis, Jr., at the meeting of the New York Section of the Electric Vehicle Association of America on Dec. 28. Mr. Curtis has just returned to this country from a two years' residence abroad, where he was manager of the London office of the General Vehicle Company. The speaker found it difficult to sell trucks in England for other reasons than those cited above. No corporation can increase its capital without first asking the permission of the government, and this makes financing difficult. So many of the central stations are functions of the local government that it is difficult to enlist any co-operation from this source, and in fact antagonism is frequently shown. The natural conservatism of the people is a further drawback besides the antipathy of all Englishmen to anything imported. In London it is especially difficult to sell electric vehicles owing to the different kinds of service in all localities. The city is supplied from many sources, which means that there is a wide number of voltages both for alternating current and direct current. The battery situation is about the same in England as in the United States, all kinds being available. A great many electric vehicles now in use in England are of German make.

The other speaker at this meeting was S. C. Harris of the New York Edison Company, who presented a paper on standardizing of battery compartments. By making minor changes in the battery compartments of the company's fleet so as to standardize compartments for a truck of given capacity the author was able materially to reduce the number of batteries necessary to be kept on hand for emergency use and thus appreciably to lower investment charges.

Decision in Pacific Power & Light Company's Rate Case

Washington Commission, After Investigations Covering Two Years, Orders Reduction in Irrigation and Residence Rates—Company May Take Case to Court

As the result of valuation and rate hearings held in the State of Washington during the past two years, the Public Service Commission of that State has handed down a decision in the Pacific Power & Light Company case which reduces that company's residential and irrigation rates. The case and the decision are unusual from a number of points of view, and it seems probable that the Pacific Power & Light Company will appeal the case to the courts because of some features of the decision.

The company serves a town and rural business throughout the Columbia, Yakima and Walla Walla Valleys in Oregon and Washington. Approximately 100,000 people are served with electricity and a smaller number with gas and water. Only the electric-light rates in Washington are considered in the order.

The company maintains about a dozen schedules, relating to various classes of business. The commission finds that all but three of these schedules are just and fair, but has called for a reduction in three schedules.

Apportionment of Property

The decision, it is claimed, is not based on an analysis of the cost to serve or on the valuation of the company's property, but largely upon comparative figures of rates in other communities. All the towns affected by the decision are served from one generating and transmission system. The rates in two communities not attached to the generating and transmission system were left undisturbed, these communities being White Salmon and Goldendale. The valuation of the company's property was apportioned to the various communities by the chief engineer of the commission by charging each community with such parts of the plant as were directly used by that community, such as substations and distributing systems. The generating and transmitting plant was apportioned to the various communities on a basis of maximum demand, all questions of distance from power houses and other similar points being disregarded. This was done for the reason that there were power plants at each end of the transmission system and also other power plants situated at intermediate parts of the system. The commission has adopted the chief engineer's report in its findings, which indicates that it looks with favor upon the division of generating and high-tension systems on the basis of demand rather than on proximity to a power house or any other conditions.

Territory Grouped for Rate-Making Purposes

The company, previous to the hearings, had divided the various towns on its system into groups, the residential and commercial rates in each group varying slightly, although all other rates were practically the same regardless of the location of the branch. The company contended that there were various local reasons why rates should be higher in some communities than in others, although it contended that each branch should be charged the same amount for the energy delivered to it from the transmission system. The commission has also divided the communities into various

groups, giving lower rates to some communities than others, on the theory of size of the community and other similar conditions.

The commission, as far as residential lighting is concerned, divided the towns served into four groups, the gross rates ranging all the way from 9.44 cents per kilowatt-hour in the larger communities up to 13.33 cents in the smaller communities, all subject to a 10 per cent discount. These rates are for the first 60 kw.-hr. consumed per month. All above that number are charged for at somewhat reduced rates, but it seems improbable that many customers in these communities will use more than 60 kw.-hr each, so the secondary and tertiary parts are of comparatively little importance. The old net rates of the company ranged from 10 cents in the larger communities up to 13 cents in the smaller communities, with the exception of two where a sliding scale rate beginning at 15 cents net was charged because of franchise requirements. These two communities are small and do not affect the computation.

STANDBY RATE FOR IRRIGATION SERVICE MODIFIED

The Pacific company has been charging for its irrigation service a standby rate on the basis of $12 a year per horsepower connected, plus either metered running charges or flat-rate running charges, during the summer months when the energy was used. The commission has abolished the $12 a horsepower-year, connected-load payments and, instead, requires a fixed charge of $1 per month per horsepower, payable only during such months as the plant may operate. As a practicable proposition, this has the effect of reducing the company's earnings from $6 to $7 a horsepower-year of irrigation load connected. The company's average irrigation earnings per horsepower connected have been approximately $18 a horsepower-year of connected load. The proposed earnings will be approximately $11 per horsepower-year, and it is largely on this account that the company purposes to take the matter into court.

RATE OF RETURN, 5.7 PER CENT

The commission finds that, under its own valuation of this estimate of the rates provided, the company will earn on its electrical properties in Washington a return of 5.7 per cent. The commission contends that the increased use of energy will raise this figure considerably. The company at the hearing showed that the theory of increased use because of lower rates was incorrect by citing its experience at North Yakima, where a reduction in rates in 1911 reduced the annual earnings from about $206,000 to $175,000, and now after four years the earnings are up to $190,000, or still $15,000 short of the former earnings.

BASIS OF MODIFIED IRRIGATION CHARGE

That part of the decision regarding the charging of a "maintenance and investment" type of rate presents some rather unusual views of the electrical business and is reproduced below:

"In schedules 'G' and 'H' of respondent's tariff is found a charge of $12 a horsepower-year of the connected load, payable monthly. This charge is termed 'maintenance and installation' charge. If a 50-hp. motor is installed by a consumer of electrical energy, to be used for irrigation purposes, the consumer pays $50 a month, or $600 a year, although he uses the motor and consumes electrical energy for but a few months in the irrigation season. The cost of installation and maintenance varies only slightly with the size of the motor. A 1-hp. motor costs the consumer $12 a year for maintenance and installation, while a 50-hp. motor costs the consumer $600 a year for maintenance and installation, a difference of $588. No such difference in cost exists. A 50-hp. motor will operate, under ordinary conditions and under the conditions in this case, with the same wiring, the same poles, the same insulators, the same tie wires and the same meter that a 1-hp. motor would require. The injustice of this practice may be clearly illustrated by a concrete case. Two farmers are situated on the respondent's main line. The one installs a 1-hp. motor, the other a 50-hp. motor. In each case the farmer pays for the installation of his motor. The cost to the company of reading the meters, maintenance and installation is practically the same, yet one farmer is required to pay the company $588 a year more than the other. If the commission allows $2.50 as a 'connecting and disconnecting' charge, it seems that all of the rightful demands of the company for this service have been recognized."

COMPARISONS WITH OTHER COMMUNITIES

The commission in working up its rate comparisons used rates in effect in Washington in a number of smaller communities in the Puget Sound region to show that the Pacific company's rates were high. The comparative rates used were all those of the Puget Sound Traction, Light & Power Company, and prevail in places which are served as a side issue, the company's main business being in Seattle. The Pacific company believes that this method of comparison is grossly unfair, as the Puget Sound company's small-town business is furnished at much lower rates than would obtain if Seattle were not a part of the system.

Many of the compared rates from California are in the same category, inasmuch as they are for communities served by the Pacific Gas & Electric Company as secondary to its main San Francisco business. Some of the other California rates are used in cities of 100,000 population, as compared with towns of 20,000 on the Pacific Power & Light Company's system.

The commission's decision states that the company has a number of large contracts that favor special patrons with unduly low rates, but the company made clear at the hearing that most of these contracts are on regular schedules and that the same rates are open to any customers with the same type of load. It further appears that if the proposed irrigation rates ordered by the commission are used, these larger users of irrigation power will get materially lower rates—not higher ones.

The Coming Issues

NEXT week's ELECTRICAL WORLD—the second issue for January—will, following the usual plan, be largely devoted to the subjects of station and operating practice, with an important leading article on the methods and results of tests on the high-head waterwheels of the Tallulah Falls station of the Georgia Railway & Power Company. Although rated as 16,000-hp. units when operating under an effective head of 580 ft., these waterwheels have carried loads as high as 18,600 hp. under test. Other articles will discuss installation and operating methods, and there will be the usual departments. In the third issue of the month, the engineering number, will be published, among other special articles, an account of the engineering features of the new Equitable Building in New York City. The fourth issue brings the cycle around again to the commercial number of the month, and in this special emphasis will be given to merchandising methods and plans for broadening uses of electricity.

Influence of Panama Exposition Illumination Seen in Widespread Building Flood-Lighting

Although the illumination of the matchless Tower of Jewels and other Exposition structures remains only as a memory, the principle of flood-lighting there developed on so extensive a scale is now being employed for the exterior illumination of many important buildings in all parts of the country. Prominent among these installations is the flood-lighting of the Boston State House, pictured at the top of this page, together with the banks of projectors used; the nightly illumination of the 750-ft. Woolworth tower, New York City, shown at the right of the Tower of Jewels; the Wadsworth Atheneum, at Hartford, Conn., with its gray façade and towers set off by the surrounding dark lawn; and, at the bottom of the page, the Waterbury (Conn.) city hall, and the N. E. L. A. "Welcome" colonnade erected last June in San Francisco. Other pictures herewith show commercial applications for the lighting of signs and business buildings to gain the attention of the passing public after nightfall.

Finance, Commerce and Public Policy

A Survey of the Broad Business Conditions of the Industry for 1915 as a Basis for Development in 1916, Including Contributions on Foreign Commerce, the Domestic Market, Commission Regulation, and the Engineer in Public Service

"The opportunity which is presented is one that is without precedent. Public utility and other classes of industries in foreign countries, including many electrical properties, will be in imperative need of capital for extensions and for rehabilitation purposes."—CHARLES A. STONE.

The International Opportunity Opened to America

BY CHARLES A. STONE

President American International Corporation

THE United States is the only reservoir of capital which remains undiminished by the European war, and this unusual condition is the practical reason why the American International Corporation has been organized to undertake a unique work.

The opportunity which is presented is one that is without precedent. There will be a great many demands for capital from legitimate going enterprises of every description. Public-utility and other classes of industries in foreign countries, including many electrical properties, will be in imperative need of capital for extensions and for rehabilitation purposes. To a large extent they will be obliged to turn to this country. In South America, for instance, many properties have been controlled by European interests, which provided new capital as it was required and incidentally stipulated that they should have power to place the orders for supplies. It has been the general custom to place orders controlled under such conditions in the country which furnished the capital.

OPPORTUNITY NOT TO BE DISREGARDED

Now the world is forced to confront the fact that the European countries, which heretofore have had abundant capital for foreign development, have drawn so heavily on their resources that their margin is reduced or gone. They will need capital for internal reconstruction and development and for the rehabilitation of their own industries. The opportunity presented to the United States to become a banking and investment nation of international importance is one that cannot well be disregarded. If the country as a whole fails to realize the opportunity, its chance will be lost. Without regard to what may be done now, the ultimate decision on the question of whether or not the country shall become a permanent international investment center rests with the people. If the nation is not thrifty, it may not have the necessary surplus to lend.

In addition to the going enterprises which will require capital, a great many cities in South America, and in other parts of the world, lack funds for furnishing necessary public facilities. In a number of cases they have never been financed properly. While the basis of their credit may be sound, they are suffering from the inability to borrow. Municipalities in such countries cannot sell bonds, however sound they may be, to United States investors under the conditions which prevailed heretofore in this country. But if twenty loans of this nature should be made, averaging, say, $1,000,000 each, they might be used as collateral security for an issue of debentures of a United States company and find instant favor. If the American International Corporation should make loans of this nature in connection with its other activities, its credit would be behind the debentures, and the remote foreign city would not have to face the criticism that its responsibility and credit were unknown factors.

Another large field for activity by the corporation will be the financing of new industries. The organizations and experience represented in the board of directors assure a careful technical and business consideration for every proposition of merit which seeks our aid in raising capital. While at the present moment we are considering mainly going concerns, in time we shall be prepared as readily to undertake promising projects involving new construction as to invest in the securities of established companies.

LARGE FIELDS FOR DEVELOPMENT

Although it is not the plan to restrict our operations to any one group of countries, or even to any specific part of the globe, we feel that the three large fields for development will be in Latin America, the Orient, and, after the war, in Russia. The work of rehabilitation in Europe may provide an important outlet for our capital In whatever fields we operate we shall seek to have sufficient organization to represent our interests, and we shall plan to have identified with us ultimately a large number of young men of character and promising ability who will undertake business missions for us which will make them familiar with our affairs. In the Stone & Webster organization we have followed with good results the plan of forming colonies of the younger men, who learn the value of co-operation and gradually become familiar with the principles of management.

In its progress the corporation will be guided by the fundamental idea that its function is to furnish means for the investigation of propositions so as to determine whether or not they justify American investment. We

do not look on the situation as one which invites business conquest, but rather as one which demands the extremely prudent conservation of the available capital left untouched by the war. To the end that the economic and physical damage done by the war may be repaired and the world be in a position to resume its progress capital is essential. Capital must be conserved and invested where it will do the most good. In order that our capital may not be overwhelmed and lost in the flood of demands that will pour upon this country such a corporation as ours is indispensable. Careful, analytical investigations will protect American investors. After the enormous destruction of capital involved in the war it would be an economic crime to permit an era of flotation of speculative, worthless enterprises.

So far as policies can be determined in advance, it will be our idea to give the preference in investment to going concerns serving established communities or industries. We shall also give preference to municipalities and other governmental agencies which need capital for legitimate public reasons. We shall look for sound propositions where investment assures the upbuilding of countries and their resources. In some cases the test will be the willingness of the local interests to partake in the financing by investment to an extent which guarantees their confidence in their own proposition.

OPENINGS FOR ELECTRICAL MANUFACTURERS

The interest of electrical manufacturers in the corporation arises from the usual condition which is applied to foreign investments, that is to say, that the orders for supplies shall be placed in the country which advances the capital. Irrespective of markets that will be developed in this way, however, the electrical manufacturers, in my opinion, can build up foreign trade if they will devote time and study to its possibilities. They will have to acquire knowledge of the characteristics of foreigners whose trade they want. They will have to develop the courage that precedes confidence in the granting of credits. And, if they are also reasonable in the matter of terms, they will find ample opportunity to reach markets that have always been closed heretofore. One of the most promising of these is in Russia, to which Germany supplied most of the electrical equipment before the war. The field there will be a tremendous one, and Germany will not have the advantage that she held before. To accept the opportunities which Russia will offer, the American manufacturers will have to appreciate the large possibilities and be prepared to meet the sales requirements. Certainly Russia will be ready to come more than half way to do business with our manufacturers. The only method which will yield the fullest measure of satisfactory results—whether in Russia, Latin America or any other remote district—will be to send the ablest available representative to the field which the American manufacturer wants to cultivate. If a manufacturer feels that he cannot afford the expense of an individual representative, he can co-operate with allied concerns. If high-class men are sent to build for permanent success instead of salesmen who seek at all hazards for single orders at high prices, real development will follow.

Our purchase of steamships from the Pacific Mail Steamship Company, which has aroused much interest, was made because an emergency was presented. If this fleet had been broken up, the west coast of Central and South America would have been left without service. Many protests arose and appeals were made to our corporation, with the result that we decided to step in and save the situation at least temporarily. We are not committed permanently to the shipping business. But we shall investigate the situation and in the meanwhile keep the service in operation.

FRIENDLY CO-OPERATION FOUND

In our operations we hope to have the friendly co-operation of governmental agencies and of the public generally. So far as government officials have expressed an opinion to the officers of this corporation they are favorable and friendly to our purposes, and we believe that they will give us aid and co-operation in our plans for international development. All of those with whom we have talked since the inception of the enterprise realize how necessary it is for the United States to develop investment interests in foreign markets.

The broadest aspect of our work is emphasized by the statement that we shall seek not only investments, but opportunities to acquire connections and interests in foreign countries and international organizations, with the confident assumption that the future United States will be an investment nation.

"The formation of the Naval Consulting Board by Secretary Daniels . . . is a notable recognition of the engineer and of technical societies."—FRANK J. SPRAGUE.

The Electrical Engineer in the Nation's Service

BY FRANK J. SPRAGUE

Member of the Naval Consulting Board

THE formation of the Naval Consulting Board by Secretary Daniels is a development of signal character in the engineering history of America. It is a notable recognition of the engineer and of technical societies. It puts many engineers, both directly and indirectly, into touch with an honored branch of the public service under conditions which are especially gratifying.

Being absolutely non-partisan and composed of members who gladly serve without compensation of any nature, the board is able to pass wholly disinterested judgment upon problems submitted to it. Secretary Daniels is entitled to praise for his resistance to suggestions of political appointments and for his refusal to appoint members-at-large. He followed strictly the method of selection from nominations by the technical societies. While it is true that electrical engineers are largely represented on the board, this is more a matter of chance than of design. Electrical engineers, however, are certainly well equipped by training and inclination to be of material assistance in the work which is contemplated, for they deal, per-

haps, with a larger variety of subjects than most other engineers.

It is the first time in the history of our government —and so far as I know in any government—that the selection in a case of this importance has been left to technical societies. Many members of the board were unknown to each other, and the names of several were not familiar to the public from repetition in the daily press. They came together with open hearts and a common desire to help, to give ungrudgingly and without price. Their function is to be constructive critics, and their sympathies are with the navy in its earnest desire to solve its problems.

The position of the engineer in public life in this country has been marked by radical differences from that of the similar technically trained man in the older countries of Europe. We know that English engineers receive special consideration, and the honored rank of Marconi in Italy is an illustration of the recognition that engineering achievements receive abroad. We hear much of the efficiency that comes from engineering research in Germany, and we know that a great many of the industrial leaders in that country are in close contact with the Emperor. Throughout Europe the heads of the great technical organizations receive merited recognition. Many are knighted or are appointed to honorary positions which attest a governmental acknowledgment of their attainments. Of course ours is a democratic form of government, and we would not have it lose a particle of the admirable spirit of equality that characterizes it as such. But engineering works, ability and originality are just as great here as in Europe. And just as effective results are obtained without recognition of any character except that which the engineer receives from his professional brethren. Though the engineer here may be adding to the wealth of the nation at a greater rate than anyone else, he may be absolutely unknown here to the general public. This condition can be changed only slowly, but it is to be hoped that such an institution as the Naval Consulting Board will give a new idea to the public of the desire of engineers to be of real public service.

The Board Viewed as a Connecting Link

With a board of this character, the Secretary of the Navy can get information from a body of men who are a sort of connecting link between the professional men in the service and the taxpayers who foot the bills. All have sufficient technical training to be able to understand the technical problems of the navy better than the average man. Without any specific standing in law, the board hears the problems of the navy and studies them. The presentation of such problems before the board means that minds with much experience in different industries are working for solutions. No one can tell from which one the best solution will come, but here is a mobilized group of individuals ready, anxious and happy to give a service to the government.

To extend this work so that more engineers will be equally ready to aid is one of the thoughts for the future. The appointment of committees by one of the technical societies to give detailed consideration to the problems which are of special concern to its appointed representatives on the board is one of the ways in which the mobilization of engineers is being carried further. My own feeling is that any man who has the capacity to give needed service ought to be willing to use a little time to help the government. Personally, I should like to have special committees appointed by the American Institute of Electrical Engineers to cooperate in the study of problems which electrical knowledge is necessary to solve. I should also like to see the board enlarged by the appointment of representatives from three additional technical organizations—the National Academy of Sciences, the Physical Society, and the Society of Naval Architects and Marine Engineers.

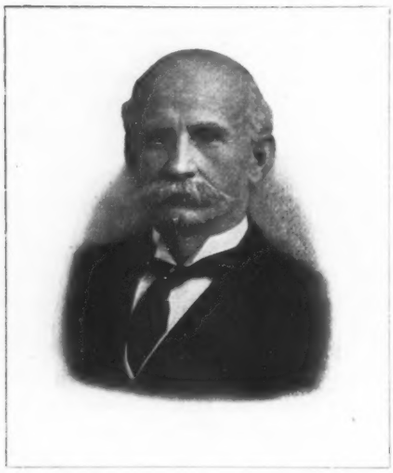
I can see ways in which such a board as has been created can be of service along additional lines, if that is not objected to by the government. If its activities stop with giving advice, when asked, only with regard to new inventions and devices or specific problems which may be troubling departments, they stop short of what can be accomplished. With great advantage they might be extended to all questions of preparedness. The subject is a large one. It does not stop with knowledge of the number of ships necessary and with studies of their proper distribution. It has to go back to the facilities for construction, the organization of plants, men and materials, the question of transportation of supplies, and the means of communication. I hope ultimately to see such a board take a permanent position in our government corresponding to that of the royal commissions in England.

The public appeared to have an idea that the board would be composed of inventors who would devote themselves to making brilliant inventions. As a matter of fact the members will not be more active in useful inventions for government use than any other individuals except as they may conduct experiments naturally and as they may be brought into closer contact with problems. Inventions, like the products of genius, represent mainly hard work. Engineering inquisitiveness will solve problems, but only occasionally is there a flash in the pan which is really a brilliant invention.

Need for Continuity of Board's Policy

Sooner or later I hope that the board may make some sort of a report on what is being proposed or done, and that this will lead to a better understanding of its work by Congress and the public. Continuity of policy is highly essential to the permanent success of such a board, dealing, as it does, with so large and efficient a business organization as the Navy Department. In any critical time, when Congress may be deliberating the expenditure of hundreds of millions of dollars, it is scarcely possible that a unanimous sentiment would be found on specific items. Then would be a time when Congress could call upon a consulting body of experienced men, feeling that they represented the taxpayers, that they were serving without expense to the government, and that they were the experts whose allotted place was to act as the witnesses for Congress in helping to settle questions of grave national importance.

The early suggestion made by Mr. Edison for a laboratory, which was indorsed by the board, is the most important definite statement of its views on any subject which thus far has been made public. The board recommends a research laboratory and experimental station to cost ultimately $4,000,000 or $5,000,000 and involving an annual expense of about half as much. This would provide a laboratory in which vast and sometimes costly expenditures could be conducted without regard to time if haste should be essential. In some matters time is the essence, and expense must be disregarded. With a large and well-equipped laboratory the government, in case of need, could divert all of its resources of men and facilities to the settlement of problems of foremost importance. The entire energy of the organization could be diverted for the forcing of rapid tests. At some junctures wholesale tests are the wisest forms of research, because they assure results of incalculable value with a minimum loss of time.



"The Sherman and other anti-trust laws should be amended so as to authorize combinations in foreign trade which would not be legitimate in domestic trade. The seaman's act and other shipping laws should also be amended in order that we may compete with the merchant marine of other countries and not be altogether dependent on foreign shipping."—MAURICE COSTER.

European Electrical Manufacturing Conditions and Our Trade

BY MAURICE COSTER

Manager Foreign Department, Westinghouse Electric & Manufacturing Company

BEFORE the beginning of the war the electrical manufacturing companies of England and of Continental Europe were doing a good business, chiefly in export trade. While the home consumption of electrical products was not in satisfactory volume before the war in any of the countries of Europe, the demand for export to the non-manufacturing countries of the world was good. All of the manufacturing companies of standing were making money. With the outbreak of hostilities the companies began to manufacture war materials of different kinds, and now, of course, all of the well-equipped plants are converted to this purpose and are operated practically under the supervision of the various governments. At present, therefore, the business of these companies is satisfactory because they are working at full capacity with assured profits on classes of output which are sold in advance of production.

Under the method of operation adopted for some of these plants, the materials are furnished by the government and the companies receive a certain percentage over the costs of labor, which in nearly every case is sufficiently large to provide a substantial profit. To protect the government under these circumstances inspectors are placed in the plants, not to supersede the owners in control but merely to exercise a general supervision in the interest of efficient operation.

EFFECT OF MUNITION MANUFACTURE ON ELECTRICAL INDUSTRY

The effect of such an arrangement—under which shrapnel cases, guns and gun carriages are made—is to diminish or temporarily to end the use of the facilities for the manufacture of electrical equipment. Well-equipped plants did not have to undergo much change to be ready for the manufacture of war materials. Standard materials are used and, while very accurate workmanship is required, not much training is essential for men who were efficient workers under the conditions prevailing before the war.

In connection with the war an enormous amount of electrical apparatus is necessary, some of which is required directly in the manufacture of war materials of one kind or another. An important result of the use of European plants for war purposes, however, is that the orders for electrical apparatus which they would ordinarily fill have to be sent to this country. Orders have been received here for non-military apparatus which our manufacturers never would have dreamed of supplying to Europe under normal conditions. Without reference to war materials, the electrical manufacturing companies of the United States are sending shipments to Europe of purely electrical materials which would usually be made there without competition from this country. In fact, some of the orders that are now being filled by United States manufacturers were placed here directly by European manufacturing companies which found themselves incapable, because of the practical seizure of their plants for military purposes, of carrying out contracts made with customers before war was declared. Sometimes the European companies are able to do a little work on electrical apparatus for purposes not concerned in the war, but find that they cannot complete it because unexpected orders from the government are received. Orders for war materials have preference over all other orders of every description.

SCARCITY OF RAW MATERIALS

Another circumstance which makes it difficult for the European companies to manufacture electrical apparatus at the present time is the scarcity and high cost of raw materials. Companies in some of the belligerent countries cannot get copper. Some of the sources of raw materials, as in the case of France and Belgium, are in the theater of the war operations, and hence are unavailable to the Allies.

Another factor is that the difficulties and great expense of shipping make it almost impossible for electrical manufacturers, even of neutral countries, to do business on a normal basis. With this combination of circumstances it is not strange that in only a very slight degree are any of the European manufacturers finding it practicable to maintain even a part of their export business. And under these conditions the British colonies, such as Australia, are turning to this country as the chosen avenue for their business.

To a large extent all of the European electrical manufacturing companies are disorganized by the absence of trained men who are at the front. Necessarily, even if peace were declared now, it would be some time before they could train new men and reach a normal basis. Many of their best men will have been killed, others will have been wounded, and some will have been made less valuable as industrial workers. The problem of providing men for places requiring a high quality of skill will not be an easy one. After the conclusion of hostilities it will take time to effect a reorganization. Nevertheless, the equipment of tools and plant will be intact in many instances, whatever may be the extent of disorganization of the human element.

EUROPEAN ACTIVITY AFTER THE WAR

In my opinion the treasuries of Europe will be so depleted of gold at the end of the war that all of the countries will try to get export business so as to attract the yellow metal and thus commence anew the accumulation of normal reserves. On the other hand, time may show that the burden of taxation will be so heavy and skilled labor so scarce that the European manu-

facturers will be unable, at any rate for a long period, to get their costs low enough to compete with exports from other countries. Although all precedents show that after a great war the cost of labor is lower, this conclusion does not apply to skilled workers.

Certainly the commendable interest which important United States financial institutions are now manifesting in the financing of foreign industries and in the establishment of branch banks in foreign countries—steps which European nations took years ago—will tend largely to divert business to this country in the future.

For business to be permanently diverted to this country, however, it will be necessary to educate the American investor to purchase securities of foreign countries regardless of the fine opportunities offered him to procure domestic investments. The American investor must be made to feel that the United States government is going to protect legitimate investments in foreign countries.

In conclusion, I might add what is already known to leading exporters and financial institutions, that the Sherman and other anti-trust laws should be amended so as to authorize combinations in foreign trade which would not be legitimate in domestic trade. The seamen's act and other shipping laws should also be amended in order that we may compete with the merchant marine of other countries and not be altogether dependent on foreign shipping as we are at the present time.

"Electricity in its service to the public needs a constant reinforcement of its means. To-day it is glad to pick up the crumbs that fall from the banquet of Mars."—T. C. MARTIN.

Statistics of American Electrical Industries in 1915

BY T. C. MARTIN

Electrical Expert, United States Census

AT the time the 1914 review corresponding to this was written the world had already known some four or five months of the awful, devastating war that still continues, unhappily with prospect of long duration. In that review it was pointed out, as in the review of 1913, that the elements for a satisfactory summation as to an art so universally pervasive as electricity were all confused and doubtful. That is no reason why the effort should not be made, as now, but it leaves the chronicler of his times with doubts and fears as to the possibility of arriving at any trustworthy conclusions or offering any credible facts. Estimating billions in the midst of dense battle smoke is not half so easy as blowing those billions into the air once a day.

The figures of electrical growth and advance used to inspire one almost with awe because of their magnitude as a record of human progress. Now, placed alongside the statistics of destructive war, they seem to sink into sheer insignificance and to be hardly worth the collation. A couple of weeks ago the Secretary of the German Imperial Treasury stated to the Reichstag that the war is costing the nations involved thirty billion dollars a year, at the present rate, two-thirds being contributed by the Entente Allies and one-third by the Central Powers. As will be seen from what follows, the best that can be predicted of electrical production and service in the United States for either 1914 or 1915 is a total of about two and a quarter billions. Our "incurable" American optimism forbids that even this ghastly showing should be accepted as the final analysis of civilization going to pieces, but one may be permitted to dream a bit of what might have happened if all this frightful outlay, which takes no account of the loss in flowering manhood and in the cruel wastage of property painfully accumulated through immemorial years, had been devoted to the arts of peace. Electricity in its service to the public needs a constant reinforcement of its means. To-day it is glad to pick up the crumbs that fall from the banquet of Mars.

THE WAR AND THE ELECTRICAL INDUSTRIES IN 1915

After a long pause, the various electrical industries of the United States were beginning to "go strong" in 1914 until the war hit them. Then came a desolating drop in production of apparatus and in income from service, and at the moment no one can know or tell what the results are or what is the resultant curve. As usual, the writer has consulted a number of leaders and authorities in the industry, whose replies are marked with friendly frankness; but their estimates are as far apart as the assumptions of indemnity which the two great contending parties in the "world war" are going to collect each from the other. At this point, before submitting estimates which will naturally go at once under "condemnation proceedings," the writer may be allowed to quote from his review of last year a warning which to-day needs more emphasis than there was then given to it: "The great monumental fact confronting any economic student is that the electrical industries of America have needed and will need millions of dollars every week for their legitimate and automatic expansion. It has been a small sum perhaps, compared with the horrid, crazy waste of war; but the trouble is that while a bankrupt nation can still put up a fight for destruction with an empty treasury, a constructive corporation has to quit unless it can pay its bills for labor and material. This should be one of the great underlying arguments against government ownership."

The branch of the industry with largest earnings is the street railways, including a rapidly growing proportion of income due to electrification of main steam lines, as, for example, that on the Pennsylvania Railroad from Philadelphia to Paoli or the extension on the New Haven road from Stamford to New Haven. But the street railways have fallen upon evil days from the coming of the jitney, just as they did in the days of the old bicycle craze twenty-five years ago, when every typewriter and every mechanic rode to and fro on the "bike," deserting the car. However, the jitney, like every other innovation, is rapidly finding its circumscribed limitations, and the trolley car is coming back to its own. The episode is proving to be, relatively, the mere raiding of bandits rather than a seizure of Bel-

gium in force. Many useful lessons are being taught as to greater flexibility of service, but the industry as a whole remains intact, with only a few dents. The estimated income of electric railways last year was not less than $730,000,000, a perfectly safe figure. Some excellent authorities assume a falling off in this year of at least 8 or 10 per cent; but many of the big urban transportation systems have been doing better, and in New York City they "are practically all enjoying a marked boom in traffic." Let us, in no pessimistic spirit, put it at $700,000,000. As a check to these figures it may be stated that, according to statistics collected by the Bureau of Fare Research of the American Electric Railway Association, from twenty-four street-railway companies in thirteen States, omitting New York City, these roads showed gross earnings for the year ended June 30, 1915, of $81,355,948. The net income of these roads in 1914 was $35,647,912, and in 1915 it was $33,954,518. There was a falling off in gross of 4.2 per cent and in net of 4.7 per cent. As against these figures it may be noted that during the first half of November New York elevated travel increased 11.3 per cent and that in Brooklyn 13.1 per cent. The Interborough of New York City was doing $10,500 a day more business in November than in 1914.

CENTRAL STATION EARNINGS SHOW INCREASE

Coming next to central-station earnings, the same difficulty is encountered of finding a firm basis of estimate. It is notorious that many systems in cities and sections of the country were badly hurt; some of them suspended payment of dividends or cut the rate of return on investment. Yet now in almost every case they are back to normal, and in various instances the gross and net earnings have jumped far beyond any previous records. This is not only true of cities like Pittsburgh and Detroit, where war manufacturing may perhaps be credited with much of the gain, but applies to places where the picking up of a heavy new industrial load is in evidence. It is said, for example, that more electric furnaces have been sold in the United States in the last six months than in the previous five years. That goes for something, but there are huge gains in other fields of which little is yet generally known. Last year the amount of earnings from central-station service was placed at $400,000,000, which was certainly near the mark, possibly an underestimate. A gain of only 5 per cent would put it for 1915 at about $425,000,000. Let it go at that.

The estimate for telephone-service earnings in 1914 was $350,000,000. The last report of the Bell system, which, of course, did not include the independent companies, showed a gross revenue of $226,000,000, and, allowing only half as much more for the "independents," the figure for 1914 is fairly reached. But has it been equaled or much exceeded during 1915? This is quite doubtful. The best evidence obtainable would show that the Bell system has gained about 8 per cent over 1914, as it did in 1915, but the writer fears to assume any such gain on the "independent" systems. Facts seem to point, if anywhere, the other way, so that it is safe to let the estimate of 1914 stand again.

On the other hand, it is beyond question that the good old-fashioned art of telegraphy has had a decided boom. For the year ended Dec. 31, 1914, the Western Union system reported gross earnings of not less than $46,265,000. The estimate in these pages of the yield of all telegraph service in the country in 1914 was $85,000,000, which under the circumstances was obviously very conservative, even if the Postal company's system did not rival that of its opponent in gross revenue. There are a good many telegraph systems in this country and many varieties of telegraph service. According to an official statement that cannot be controverted, the Western Union business up to Sept. 30 was 6 per cent better than last year in gross and not less than 70 per cent better in net—which is "going some." It is believed that the annual statement due in January will show an increase in gross of about 10 per cent. There can hardly be any cavil if, after a year when land lines and submarine cable have done the biggest stunts—not forgetting the wireless by any means—the telegraph income all told is put at $100,000,000.

EXTRAORDINARY YEAR FOR ELECTRIC MANUFACTURES

Possibly of all fields of electrical activity that in electrical manufacturing is just now the most difficult to estimate closely, one reason being that it is so hard to say what is electrical manufacturing and what is not. Of course, one should exclude all the enormous war products of the munition class and otherwise, but everybody knows that a very large number of electrical factories have been engaged in such work and that a good deal of it has also been "legitimately" electrical. One authority remarks: "The present year has been somewhat unique as regards the character of electrical production, for until comparatively recently there was a scarcity of orders for, and consequent production of, large apparatus for both central-station and electric-railway purposes; but the year stands unprecedented as regards the extent of industrial applications of electricity, resulting in almost a 'famine' in industrial motors." This is true, but at the moment the cry for generators is intense, and the builders are loaded up with orders carrying them a year ahead at full capacity of production. As a general proposition, the official figures in New York State showed for November in 1300 manufacturing plants 4 per cent increase in operatives and 6 per cent increase in wages over October. There is also to be borne in mind the higher cost of materials, notably copper. Hence, if the figure of 1914 of $450,000,000 for electrical manufacturing was correct—and it was surely near the mark—a total of $500,000,000 might be assumed for 1915. Yet one authority with wide range of observation says: "We have found 1915 in general to be not so good as 1914. If you take $450,000,000 for your figure for 1914, then 1915 would not be more than $400,000,000 to $425,000,000. This is figuring on the electrical manufacturing business, and not on the war business that some electrical manufacturers have taken." If, therefore, the estimate of 1914 be allowed to stand, there cannot be much complaint of extravagant optimism.

The income of "isolated plants" and "miscellaneous" may be left where they stood last year. The isolated plant tends to diminish relatively year by year, while "miscellaneous" sources of electrical service and income tend to rapid multiplication, especially in electrometallurgy and electrochemistry.

The table of gross income of electrical industries and service for 1915 herewith submitted is subject to the calculations and checks suggested. It can at best be only an estimate, but, on the other hand, the fundamental data are not far to seek and would indicate that it cannot be very far wrong. The estimates bring out an increase of only $10,000,000 on a previous grand total of $2,265,000,000 estimated for 1914, every item in the total having since, where possible, been closely verified or more than made good:

Electric railways	$700,000,000
Central stations	425,000,000
Telephone service	350,000,000
Telegraph service	100,000,000
Electrical manufacturing	450,000,000
Isolated plants	125,000,000
Miscellaneous	125,000,000
Total	$2,275,000,000

"The development of efficiency and of systematic methods to prevent loss and increase gain in every department of business means that all standards will be more exacting."—EDWARD N. HURLEY.

Knowledge of Costs as a Basis for Manufacturing Advance

BY EDWARD N. HURLEY

Vice-chairman Federal Trade Commission

NO constructive work that the Federal Trade Commission has undertaken is of more fundamental importance than its study of cost-keeping methods. The failure of manufacturers to know their costs of production and their selling expense is the germ of a long train of evils. Experience as a manufacturer has taught me very forcefully the truth of this; and contact as a public official with many business men in all parts of the country has deepened my feeling that the failure to calculate costs accurately is a point of serious weakness in our industrial structure.

In speaking to the electrical industry on this topic I am not unmindful of the fact that many organizations have followed correct accounting systems and have the invaluable knowledge that comes therefrom. Those whom the Federal Trade Commission hopes to benefit are the manufacturers who have never made a proper analysis of costs. Indisputable and prompt information of such a nature is absolutely indispensable to the seeker for trade in foreign markets. For the overseas commerce has been developed by masterly policies of co-operation between European manufacturers and governments, and this kind of competition cannot be met successfully by any American who has not at his command at all times the fullest and most detailed data.

PRINCIPLE, NOT FIGURES, IMPORTANT

It is only the principle involved that concerns the Federal Trade Commission. The commission believes that it can be of real service to business interests by promulgating standard systems of accounting for use in different industries. That this plan is thoroughly practicable is shown by the appointment of an advisory council by the American Association of Public Accountants to consult with the commission on this subject. With the co-operation of this professional body the commission desires to present rules that will materially strengthen the position of the manufacturer both as a selling factor in world trade and as a borrower with sufficient credit to carry his projects to a successful conclusion. The results obtained from the introduction of such systems are not the business of the commission. It is not the figures that interest us. It is the opportunity which is opened, entirely apart from the work of regulation laid down in the law, to accomplish something constructive in a large field for usefulness.

Many a manufacturer doing a good volume of business is hampered more than he realizes by a lack of ready capital. If he knew how to proceed to get capital, he would find plenty at hand for his legitimate needs. He knows the mechanical details of his business; he has solved the problem of finding a market for his products, but he cannot expand at a rapid rate. He is on friendly terms with his banker, who regards him as a business man of small affairs. In the course of time, if all goes well, he may possibly amount to something more, the banker concludes. He is one of many thousands, all rated as of about the same indifferent grade. He has not tested his standing as a borrower; the bank does not know enough about him to risk much on credit.

"AN ILLUMINATING SYSTEM OF ACCOUNTS"

What such a man needs, first for the protection of the business which he has, and second in order that he may live, grow and prosper, is an illuminating system of accounts. Without it he cannot make himself understood by the banker. He is assured that he is as sound as a dollar, but the banker, who deals mostly in the money of other people, has to develop his own confidence in a borrower before he feels at liberty to intrust capital to him. And the best introduction to the good will of the lender of commercial funds is an adequate statement—full and frank.

The business man must talk the bankers' language. Important as this is now, it will be absolutely essential in the more rigid requirements of the future. The development of efficiency and of systematic methods to prevent loss and increase gain in every department of business means that all standards will be more exacting. Against the day of closer reckoning which will have to be confronted in the coming years every business man should prepare himself.

HAMPERED BY FAILURE TO GRASP OPPORTUNITIES

Why should a business man be hampered by lack of capital when he is honestly entitled to a line of credit that would fit him to enlarge his capacity, his markets, his profits? Yet we find frequent evidences of individuals who are held back simply because they have not appreciated their opportunities. One man, whose case is typical of others, said: "Why should I bother about foreign trade when domestic orders take the full production of my plant?" This man does not see that in failing to look into foreign possibilities he is overlooking markets that would increase his output and lower his costs. Nor does he understand that a foreign competitor, by expanding rapidly, may be getting ready to offer serious competition in the very home market which he is nursing so carefully. Opportunities for growth are too important to be overlooked, and the value of co-operation of bankers is too great a factor to disregard.

When a scientific record of costs is available to a manufacturer it is inevitable that he shall study his business from different angles. Some years ago, as a manufacturer, my attention was called to the number of machines which were returned by prospective purchasers after a trial. An investigation into the cost of shipments showed a heavy charge per machine and an enormous aggregate which had to be absorbed in total costs. So it was decided that an initial payment of $10 would be required in every case. This not only had the effect of preventing the waste of shipment expense, it also had the gratifying result of accomplishing this end without reduction in the volume of sales, because no purchaser wanted to lose the initial payment. It is

a time of the year at which accounts are balanced, inventories are taken and plans and policies for the new period of twelve months are laid. Much will be accomplished for the future of American industry if 1916 shall witness the adoption of better accounting systems by manufacturers who have heretofore neglected that vital department of their business.

"With mutual confidence established and the greatest frankness prevailing with respect to the problems of the industry, the utilities may face the economic conditions which now appear large on the world's horizon with a greater degree of assurance than at any previous time."—WILLIAM J. HAGENAH.

The Development of the True Function of the Commission

By William J. Hagenah

Public Utility Statistician

THE record of public-utility regulation during 1915 is a story of conservative but substantial progress. Regulation by state commissions has become a generally recognized and settled fact. The character of legislation on this subject was of a distinctly more favorable tone, the number of companies involved in rate and service controversies showed a tendency to diminish, and in the decisions which issued there is manifest a clearer insight into the practical problems of utility growth and operation, a misunderstanding of which has so often been responsible for the lack of cooperation between the public and the corporations. The year has been marked by a large number of decisions, and while only a few were of more than local interest, yet upon analysis there appeared for the first time an approach toward uniformity in the recognition of the underlying fundamental principles and in their practical application to the facts presented.

To the student of the public-utility movement in America nothing has been more discouraging than the apparent confusion in the opinions of the different state boards and the difficulty of finding precedents on bases at all comparable. As legislative bodies, engaged in the determination and interpretation of facts, the early opinions of these commissions showed the widest possible variance. As illustrating this condition, some commissions refused to make any allowance for going value, while others have been insistent that this is a legitimate part of the fair value of the property but here differed in the measure of such allowance by amounts ranging from 3 per cent to 30 per cent of the value of the physical plant alone. The allowances for overhead charges have ranged in appraisals of the same class of property from 12 per cent to 28 per cent, and so different has been the classification of costs and the manner in which these computations have been made that in some cases the commission allowing 12 per cent was in fact more liberal than the one allowing 20 per cent. The provision for depreciation in some states has been more than twice the permitted charge in other states. A like variation has existed in the methods adopted for determining the present or depreciated value of the property and the provision for working capital. Some commissions have accepted not less than 8 per cent as the measure of a reasonable return, and this in the great investment centers of the East, whereas only 6 per cent has been allowed in some agricultural states of the Middle West. So wide has been the variation in the decisions of different commissions, and even between the decisions of the same commission separated by an interval of years, as to give rise to the belief that each commission was developing methods of procedure for its own use, without regard to the rulings of other states.

Settlement of Disputed Questions by the Courts

Two facts during 1915 have tended to a distinct betterment of this condition, namely, a growing recognition of the true function of a public service commission and a definite settlement of many disputed points by the decisions of courts of last resort. It is not many years since regulation was considered synonymous with reduction of rates. That public-utility rates were too high and the service inadequate and inefficient was then a common impression. However one may regard the subject of regulation, it is impossible from a reading of some of the early decisions not to feel that in certain cases at least the analyses were made to fit the exigencies of the situation. Where it was possible to grant a reduction in rates and still be liberal in matters of valuation and the rate of return, liberality toward the utility was given prominence. Where a less favorable interpretation of the facts was necessary to make possible a reduction, the estimates and allowances were reduced apparently without regard to consistency with other decisions. There were also decisions obviously prepared to appear severe on the surface, but which on analysis of the rates prescribed showed a liberal return on the fair value of the property. Other decisions, seemingly conforming to the best precedents, prescribed rates which failed to earn even bond interest when put into effect.

When we consider the temper of the public mind out of which the demand for regulation grew, this condition is not unnatural. Smarting under the activity of certain utilities in municipal politics and the undisputed fact that large profits were made in some cases, the public launched its campaign for regulations at a time when but one conclusion with respect to the offending companies was possible. That a substantial reduction in rates was justified in every case was generally felt, and the decisions for some time were all in this direction. This condition, however, no longer exists. The most conspicuous instances of excessive rates have been analyzed and adjusted, and it has been found that these widely advertised instances of great profits were not typical of the industry as a whole. In fact, petitions for increases in rates have become common, and relief from unreasonably low rates is no longer so infrequent as to incite comment. Our commissions today occupy a position akin to that of a court, and we discover in the decisions a judicial viewpoint and dis-

criminating judgment out of which are growing uniformity in analysis and a regard for precedents. In fact, it is now becoming possible for companies acting alone or in co-operation with the city authorities to adjust rates on a basis approved by the commissions without the former lengthy and expensive hearings.

THE FUNCTIONS OF THE COMMISSION RECOGNIZED

In this evolution of regulation commissions are more nearly discharging the functions assigned to them. The legislatures have declared the policy of the states and directed that values shall be "fair" and returns on the investment "reasonable." Academic discussion and hair-splitting refinements of matters founded on estimate in the first instance are giving way to a broader consideration of facts, of law and of economics. There is less disposition to describe as "reasonable" rates which are just on the safe side of confiscation, and there is a greater desire to find conclusions more consistent with the earnings in other fields attracting capital and with which the public-utility industry must compete. It has also been learned that proper rates and adequate service can be given to the public without embodying in the decision a mass of dicta having a tendency to discourage utility investments.

While improvement is apparent in the decisions of the commissions, the opinions of the courts during 1915 have been important and far-reaching. When precedents were lacking and the law with respect to valuation and rate-making bases was uncertain in many important particulars, it is not surprising that inconsistency should have developed, due as much to the loose thinking and natural bias of corporation and municipal partisans as to the individual views of commissioners. In passing on matters affecting public regulation our courts have proceeded slowly, the wisdom of which course is generally recognized. Each year we have received definite judicial expression on some important subject of controversy, and 1915 has contributed the decision of the United States Supreme Court that going value "is a property right and should be considered in determining the value of the property upon which the owner has a right to make a fair return." This opinion, together with the somewhat earlier decisions of the state courts of New York, will exercise a most important influence on future questions of valuation and rate-making.

The year 1915, however, has not seen public utilities entirely out of the woods. The baneful influence of politics still makes its presence felt. The existence of a great utility property, whether publicly or privately owned, whose service enters into practically every home in the city, offers a tempting field for exploitation, and it is probably futile to hope for the complete elimination of that type of citizen who seeks to arouse public sentiment against utility services for his personal advantage. A certain amount of criticism is not without beneficial and stimulating effect, and although at times trying and also expensive, it may have to be accepted as a part of the price for operating the service under our lax city governments. Contests for the control of commissions still arise in those states which have more recently created machinery for utility regulation and the policy of the commissions frequently changes with a change in the political complexion. However, most of the changes have been in the direction of betterment, and the progress which has been made along these lines during the last five years justifies the hope for further improvement in the coming years.

In many states competition in utility service continues. Franchises for competing utilities are now seldom granted, but the evil resulting from the operation of duplicate plants is still apparent in many cities. If it is contrary to the public interest to permit a competing plant to be constructed, it is equally wrong to permit existing competing plants to make large extensions into the same territory. In either event the expenditures are largely economic waste. Some day the continuance of an erroneous public policy will be deemed just as much a subject calling for restrictive legislation as are attempts to institute such a policy in the first instance. Another illustration of incomplete and inconsistent regulation has existed with respect to the "jitney" competition against street railways. Although deep inroads have been made into the earnings of the traction companies, public authorities in many states have been slow to act. That this competition is diminishing must be attributed more to the natural failure of the venture than to a constructive exercise of the regulative power.

EFFECT OF INCREASE OF COMMODITY PRICES

Another condition with respect to which the public utility position has not been improved in 1915 is the constant increase in commodity prices. During the last fifteen years this gradual increase has been noticed, but not until 1910 did it assume a serious aspect. The significance of this condition is indicated by the fact that commodity prices and wages are to-day practically at their highest point since the civil war, and there is every indication that they will continue to rise, while, conversely, the purchasing power of the dollar of income is diminishing. Unlike the mercantile and manufacturing establishments, the public utility is unable to shift this ever-increasing burden, and it is probable that in the near future petitions for increases in rates will become more numerous. Many utilities—especially those which, like traction companies, have more nearly reached the saturation point in their service—are in a weaker condition to-day than ten years ago, even though their business has greatly increased. One large street-railway system is now petitioning for relief from a schedule of rates prescribed by a commission and regarded as satisfactory but a few years ago. In several of the largest cities telephone companies are seeking increased rates and changes in the form of their service which will tend to reduce operating expenditures. In the future work of the commissions we shall doubtless hear more of operating costs and less of investment costs, for it is in the operating statement that the full and direct effect of the price increases is most felt.

It may be concluded that the year 1915, while lacking in any spectacular development affecting this industry, has witnessed substantial progress in the solution of those problems for which the commissions were created and has seen a great improvement in the accuracy, efficiency and justice of their work. The quest for infinite detail is giving way to a broader vision and better understanding of the practical problems of utility operation. This condition has also been aided by the greatly changed attitude of the utilities themselves with respect to public regulation and a desire for closer co-operation with the public. The highest courts by their decisions have removed from the realm of contention some of the matters which have heretofore been the subject of the widest differences between the public and the corporations. It may safely be said that as a result of the present attitude of the commissions and the utilities there is being built up a deeper appreciation of the rights of each party and a realization that only through co-operation can the best results be obtained. With mutual confidence established and the greatest frankness prevailing with respect to the problems of the industry, the utilities may face the economic conditions which now appear large on the world's horizon with a greater degree of assurance than at any previous time.

Technical and Engineering Progress

Tendencies in Electrical Science and Applied Engineering Indicated by Special Reviews in Physical Science, the Development of Dynamo-Electric Machinery, Prime Movers, Electrical Transmission of Energy, Radiotelegraphy and Radiotelephony, Electrochemistry, Lighting and Electric Heating

The Development of Applied Science in 1915

BY DR. A. E. KENNELLY
Professor of Electrical Engineering, Harvard University

DESPITE the unabated continuance of a war of wholesale destruction and of reversion toward barbarism with the aid of modern engineering methods, the year 1915 has witnessed some noteworthy achievements of electricity which tend to wage war on war and make constructively for the permanent uplift of man.

The principal electrical event of the year has probably been the radio transmission of speech from Arlington, Va., near Washington, D. C., to Pearl Harbor, Honolulu, a distance over the globe of approximately 7800 km., or 4200 nautical miles. Speech from Arlington is stated to have been also recognized at Paris, France, at Darien, Panama, and at San Francisco and San Diego, Cal., so that it is reasonable to assume that under favorable atmospheric conditions it might also have been heard in all directions from Arlington to the Honolulu range of 4200 nautical miles, or from beyond the pole in the north to beyond Coquimbo, Chile, in the south, and to Italy in the east. Although the voice is described as having been very faint at Honolulu, yet it was clear, so that the particular speaker at Arlington was recognized by the listener at Honolulu.

Since the angular distance from Arlington to Honolulu is 70 deg. of arc and the equator with reference to Arlington as pole would be 90 deg. distant, the inference is that the human voice was carried in these experiments to within 20 deg. of the sending station's equator. This means that one-third of the total surface of the globe was probably invaded, to a possibly recognizable degree, by the tones of one human voice.

Previously to these attempts radiotelephony had been carried to a range of a few hundred kilometers, but the enormous increase in range suddenly attained this year means that a result of a new and different order has been achieved. The relation of human beings toward the globe they inhabit has become altered. The world has not actually altered in its dimensions, but the great distance to which man has suddenly become able to make his voice heard has virtually caused the world to shrink to relatively small dimensions by comparison. In 1915 the whole world became a small place.

The year has also witnessed appreciable advance in radio-engineering. Rational formulas for operating ranges, tests and efficiencies have advanced in precision and reliability. New data have become available to engineers for dealing with skin effect in electric conductors and with the phenomena of oscillating-current circuits, so that these phenomena are rapidly extending from the domain of mathematics and physics into the workshops of applied science.

Engineering science has made notable advances during the year in the design and construction of very large turbo-generator units. Units of 30,000 kva. are in service, and one of 35,000 kva. has recently been brought into operation. The kilowatt and kilovolt-ampere are actually units too small for the most convenient designation of such large outputs. The megawatt and megavolt-ampere are of a more suitable size; so that this year's accomplishment is a 35-megavolt-ampere unit. It is said, moreover, that a 50-mva. turbo-generator unit has been ordered.

The success of the United States collier Jupiter, built two years ago with high-speed steam turbo-generators and low-speed electric motor-driven propellers, has led to the commencement this year of the first electrically propelled battleship, the U. S. S. California, which is to transmit some 27.5 megawatts from high-speed turbo-generators to low-speed electric motors on the propeller shafts, the gearing or speed ratio being adjustable electrically by changing the number of poles in the motors. The high coal economy and the absence of racing of the propeller shafts are notable features of this electric propulsion.

Long-distance main-line railroad electrification has also made notable strides in the past year, and part of a 440-mile section of railroad has already been equipped for the operation of direct-current electric locomotives at 3-kv. pressure.

ELECTRICAL CONDUCTIVITY AT LOW TEMPERATURES

In the direction of electrical engineering theory, one of the most salient results of the year has been an explanation of some very remarkable phenomena of superconduction in metals at or near the temperature of liquid helium, *i.e.*, 4 deg. on the absolute or Kelvin scale. It has recently been demonstrated experimentally by Kamerlingh Onnes that when a small ring of lead at the temperature of liquid helium has an electric current suddenly started around it by the inductive action of a magnet the unsupported current persists for a wonderful length of time. About four days, or nearly 100 hours, has been estimated as the time required for the electric current in the leaden ring, at this temperature, to fall to one-half its initial strength. This becomes an apparent case of a very appreciable current strength persisting for a long time without any impressed emf. in its circuit; so that Ohm's law may be said to be reliable at ordinary temperatures, but to break down near the so-called absolute zero, or under the lethal influence of liquid helium. A mathematical theory to account for this break-down of Ohm's law has been presented by Sir J. J. Thomson. The action may be crudely described as the free passage of electrons from one doublet atom to its next neighbor in a polarized chain by means of a sort of perpetual bucket brigade, when the temperature is so low that the doublets can remain quiescent in long circuital chains under the stimulus of momentary externally impressed emf.

Steady advance has also been made in the laboratory investigation of crystalline atomic structure through the use of X-ray reflections. It can hardly be doubted that these investigations will lead to valuable applica-

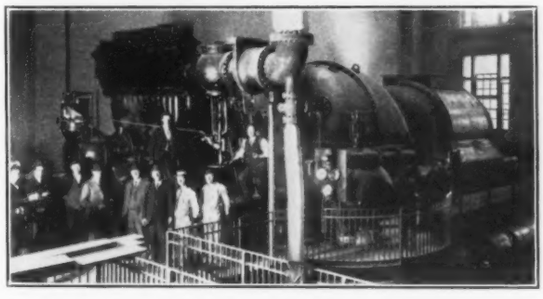
tions. Already we are led to perceive why a diamond is so hard and rigid in its structure.

THE SAN FRANCISCO EXPOSITION

A great event of the year in all departments of the world's industry has been the International Panama-Pacific Exposition at San Francisco. So far as concerns electrical engineering, it is noteworthy that for the first time in many years no special electricity building was considered necessary for the proper display of electrical engineering exhibits. On the other hand, electricity, electrical science and electrical engineering were displayed in all parts of the Exposition, and especially in the electric illumination at night, which was greatly admired. Thus electricity has come to be virtually accepted as a pervading influence in modern life that needs no special collection of exhibits for its recognition.

One of the great electrical engineering displays at the San Francisco exhibition was the daily telephonic communication by wire with New York City, as listened to by more than 200 persons simultaneously in one of the exhibition buildings. For the first time persons sitting within a few meters of the Golden Gate, on the Pacific Ocean shore, could hear loudly, by telephone, the sound of waves breaking on the Atlantic Coast in New Jersey.

Considering how many active workers have been taken from the electrical laboratories of Europe to join the armies, and how much scientific and engineering work has thus had to be postponed, it is remarkable how much has been accomplished during the year in the world as a whole. The war has revealed abundantly the necessity of organized and disciplined co-operation in all branches of applied science for the accomplishment of national industrial results. No country can in future hope to achieve social, industrial or commercial success without enlisting applied science throughout its organization.



Tendencies in Design and Construction of Power-Station Equipment

BY PHILIP TORCHIO

Chief Electrical Engineer New York Edison Company

GREAT progress has been made in the design and construction of large three-phase turbo-generators for single-phase railway operation, as illustrated by the units installed by the United Electric Light & Power Company supplying the New York end of the electrification system of the New York, New Haven & Hartford Railroad, and by the Norfolk & Western Railway Company on its electrification in the Elkhorn grade-Bluefield section of its main line.

SINGLE-PHASE GENERATOR CONSTRUCTION

The rotating fields of such generators require a very special construction to counteract the pulsating flux in the field poles caused by the single-phase armature reaction. To prevent serious heating in the field poles produced by the eddy currents, heavy damper windings are required in the poles to neutralize this pulsating flux. It may be of interest to mention in detail how the difficulties of construction have been overcome in the above-mentioned generators.

The rotors are built up of steel plates held together between heavy stub-end forgings by means of heavy chrome nickel-steel bolts put in place under a heavy initial tension. This construction enables the use of material which is practically uniform in quality in all radial directions, and, having been worked in the forging or rolling process in an axial direction, its properties are excellent in a radial direction. It also permits of the elimination of the through shaft. The plates have portions milled out, and the rotor slots are cut deeper than is needed for the field coils to increase the ventilation by providing these paths for the air, which passes through the rotor axially and is discharged radially.

The caged damper windings for counteracting the pulsating field flux consist of slot copper wedges in one piece and are also provided in portions of the rotor in which there is no winding. The chrome nickel-steel rings pass over the ends of the windings of the rotor and secure them against displacement on account of centrifugal force, and also carry copper which is inserted in the ring, just within the outer periphery, by dovetailing. Three heavy copper rings encircle each of these coil-retaining rings circumferentially; various copper feeder bars are further dovetailed into the steel rings in an axial direction. A ring of special brass composition and treatment is carefully joined with the steel ring adjacent to the rotor core and engages with the copper bars in the rotor body, thereby assisting materially toward completing the circuit for the currents which are induced in the rotor. The caged winding of the retaining rings completes the circuit of the damper windings and dampens out the pulsating flux arising from the currents flowing into the projecting ends of the stator winding. The rotor for the greater part of its axial length has grooves cut into its surface in a circumferential direction for the purpose of assisting the induced currents to flow in the copper bars provided therefor.

The construction of the stator is characterized by the use of mica insulation, the bracing of the stator coil ends, and improvements in ventilation.

Machines so constructed are guaranteed for single-phase kva. rating, at 70 per cent power-factor, of over 70 per cent of the three-phase rating, thereby giving considerably more than twice the single-phase output of a three-phase generator of former standard construction. This improvement has made possible material economies in first cost and operation of single-phase power services.

LARGE TURBO-GENERATOR UNITS

Further progress in turbo-generator design has been made in the size of units. A recent contract for a 45,000-kw. unit has been placed with one of the large manufacturing companies.

Experience with the compound turbo-units seems also to warrant expectations of further developments along lines of very large units subdivided in high-pressure and low-pressure units, thereby realizing some saving in steam economy over an equivalent single unit and allowing operation of part of the total rating in case of partial disablement.

The largest water-turbine generators ever built are those which have been installed during the past year in the Long Lake development of the Washington Water Power Company near Spokane, Wash. They have a

normal rating of 13,900 kva. and are capable of operating continuously at 25 per cent overload and 90 per cent power-factor, with an additional 15 per cent overload when additional forced-air circulation is supplied to the generator.

The water turbines driving the above generators are rated at 22,500 hp. and are of the double-inflow horizontal Francis type, each unit being made up of 83-in. twin runners inclosed in cast-iron volute casings and operating at 200 r.p.m. under an effective head of 168 ft. Results from the test runner have indicated an efficiency of 91 per cent.

For low-head hydraulic plants the improvements which have been made during the past few years in the scroll cases of reaction turbines, and which have produced marked increase in efficiency, have led to the installation of such turbines in several plants, and in some instances even to the replacement of turbines of older design.

Transformer Units and Reactance Coils

In the field of transformer design single-phase self-cooled transformers were built rated at 5000 kva. continuously and capable of carrying 7500 kva. for one hour following the 5000-kva. run, not to exceed a temperature rise of 55 deg. C., and also capable of carrying 10,000 kva. for seven minutes following the 7500-kva. run, without injurious heating. The transformers are shell-type, oil-insulated, with radiator-type cases for outdoor mounting and connected to a twenty-five-cycle, 23,000-volt system.

The large number of protective reactance coils that have now been in service for several years have proved without question their great value in increasing the continuity of the service and affording protection to apparatus. Recent development in reducing the size of these coils has facilitated the installation of reactance coils also on the feeder circuits in steam as well as hydroelectric plants.

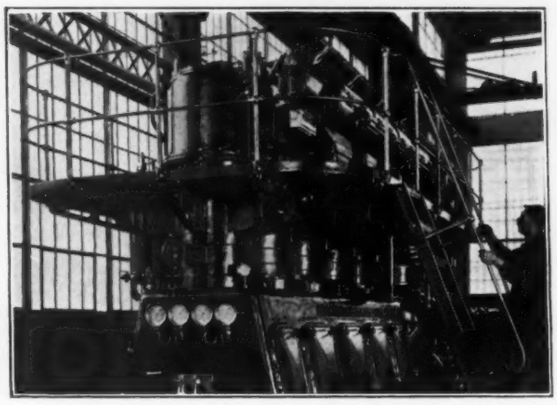
Considerable progress has also been made in the construction of relays at moderate prices. The characteristics of these relays and their consistency of operation are very much better. This greatly facilitates the selectivity of switch operation, thereby increasing the continuity of service.

Electrical Ship Propulsion

One of the notable developments of the year has been the order by the United States Navy Department of the equipment for the electrical propulsion of the United States battleship California. This battleship, which has a maximum speed of about 22 knots, will require approximately 37,000 hp. on the shaft. Power will be furnished by two steam-turbine-driven bi-polar alternators, and an individual two-speed propelling motor will be provided for each shaft.

This will insure economical operation at cruising speed of 15 knots or less, as only one generator will be required and the motors will operate on the lower speed connection. The ship will be able to make a speed of 18½ knots with only one generator in action. Speed variation is secured by means of variable-speed governors on the turbines. These governors are regulated automatically, which effectively prevents racing and enables the ship to maintain a fixed schedule regardless of the sea, weather or steam conditions.

The estimated weight of the propelling machinery without condensing auxiliaries is only 530 tons, while the simplicity and compact arrangement of the two main generating units and the four propelling motors will give an economy in engine-room space impossible to attain with any other form of propelling machinery of equal rating.



Significant Developments in Prime Movers

By William F. Durand

Professor of Mechanical Engineering, Leland Stanford University, California

In the field of central-station engineering the progress from year to year often seems slight, perhaps insignificant, and it is not until we can group a series of years and view them as a whole that we are able to appreciate the long way we have come during, for example, the past decade. The year 1915 has made its full measure of contribution to this progress, though, in the glare of other events which have crowded the year, the elements of such progress may have attracted only passing notice.

The main work of the central-station engineer still remains primarily concerned with the increase of efficiency, the saving of loss, the raising of output per dollar of investment, per pound of equipment, or per unit of area or of volume occupied.

Boilers and Fuels

Thus in the boiler room there has been no significant change in the fuel situation. Coal and oil stand as the great sources of energy for central-station service, and the attention of engineers is now directed simply toward more and more effective means of realizing the conditions for economical combustion and transfer of the heat to the water. The use of powdered coal for fuel has again attracted some attention. An entirely efficient and satisfactory means of burning coal in such form would aid in utilizing much carbon in the form of finely powdered coal or dust and would thus result in economic gain with reference to our sources of fuel supply. With oil fuel the chief advances have centered around methods of mechanical atomization, with its improved economy as compared with steam atomization.

The routine work in the fire room has undergone little change during the year. Central-station engineers are becoming more and more impressed with the feeling that the fire room is to be the scene of the next great economies in power production. In the meantime the attendant conditions in the fire room are all receiving more and more careful attention. Such are flue-gas analysis, water analysis and control for mineral content, supply and distribution of air to reduce excess, temperature measurements, control of smoke formation, time-regulated firing, more carefully arranged schedules of boiler operation when carrying a widely variable load through the day, etc.

Bigger Boilers and Higher Steam Pressures

The three significant features regarding the boiler room which have stood out boldly in the work and thought of power-plant engineers during the past year are larger units, higher steam pressures, and greater

output per square foot of heating surface without undue yielding of efficiency.

For some years 600 boiler-hp. to 750 boiler-hp. (6000 to 7500 sq. ft. heating surface) was considered about the normal upper limit in size for central-station boilers, though much larger units were common in marine practice. The tendency now, however, seems to be setting toward larger units, as shown by those of 12,200 sq. ft. each recently installed by the Commonwealth Edison Company in Chicago and the giants of 23,650 sq. ft. each installed at the Conners Creek Edison station in Detroit. Boilers of the size of the latter will probably not often be duplicated in the immediate future, but a unit of 1200 boiler-hp. capacity seems rational under present conditions, and it will not be surprising to find such boiler units coming into service generally in large station design.

Again, regarding steam pressures, it is stated on the best authority that in certain large metropolitan power plants the possibilities of advantage in such increase are now undergoing very close scrutiny, and with a view to carrying the pressures to points far beyond anything typical of present practice. Where 200 lb. has stood for some few years as near the upper limit, with an occasional essay forward to 225 lb. or 250 lb., the present plans contemplate the possibility of raising the pressure promptly to 600 lb. or 700 lb., or even perhaps as high as 1000 lb. per square inch. These are bold measures, and the engineering world will watch the introduction and development of such pressures in practice with the most acute interest.

Finally, with regard to output of steam per square foot of heating surface, we have long been led to consider 3.5 lb. per square foot as a so-called normal, because it agrees substantially with a standard adopted in 1876. It is well known, however, that without overstrain on the boiler and without loss of efficiency this figure may be considerably increased.

Thus evaporations of 5 lb., 6 lb. and 7 lb. per square foot of heating surface are by no means uncommon, and without sensible loss of efficiency. Quite recently, however, we have learned of astonishing advances in this figure—to 10, 12, 14 and even 16 lb. per square foot of heating surface, and even at these highest figures still with a very excellent efficiency. These various possibilities with regard to the boiler of the future indicate the groundwork of changes most far-reaching in character and which the next few years may see in full realization.

SMOKE PREVENTION

The general subject of smoke prevention continues to occupy the serious attention of engineers in certain of the large cities. The recent appearance of the monumental report of the smoke abatement and railroad terminal electrification committee in Chicago is an evidence of the serious effort and study which this subject is attracting. This report presents in exhaustive form the factors which enter into the problem for the city of Chicago, including a complete digest of the literature of the subject based on study and experience all over the world. Of special interest is the attempt to develop for Chicago the relative importance of the various sources of smoke pollution, such as railway terminals and switching, central power stations, manufacturing plants, etc. Notable work has also been accomplished in Pittsburgh during the year in connection with smoke abatement. Changes of a restrictive character have been made in the smoke ordinances, improved methods of stoking have been encouraged, old, inefficient boilers have been replaced with others of modern and improved type, especially with regard to furnace arrangements, and altogether a decided improvement in the appearance of the city has been realized. Like all other good things, smoke prevention becomes an economic problem. It can be realized if the public will pay the price. This is developed in emphatic terms by the Chicago report above mentioned, from which it appears that the cost of railway terminal electrification as a means toward the end of smoke prevention is so staggering as to make the adoption of such a scheme almost out of the question.

STEAM TURBINES

As a prime mover for large central-station service the steam turbine has no rival. The only question now is as to size, type, structural details and arrangements. The advance in size goes ever marching onward. Units of 30,000-kw. or 35,000-kw. rating are becoming commonplace, and we shall soon see units of 50,000 kw. or more. An interesting recent installation is at the Seventy-fourth Street station of the Interborough Rapid Transit Company of New York City, where three cross-compound turbine units of 30,000 kw. each have replaced old 5000-kw. directly connected reciprocating units dating from 1901. These units consist of a high-pressure and low-pressure half, each of which drives a generator, the high-pressure half at 1500 r.p.m. and the low-pressure half at 750 r.p.m.

There is also in evidence a trend toward turbo-units only, rather than toward the combination of reciprocating engines with low-pressure turbines, as a few years ago at the Fifty-ninth Street station.

Coincident with the advances in size and with the general improvement in detail design and in the control and design of auxiliary equipment, there have naturally come advances in economy. There is now good reason for believing that with large-size units and good general operating conditions water rates of 12 lb. per kilowatt are not uncommon, while specific instances have been given of a rate only slightly above 11 lb.

These figures must, from the nature of the factors involved, represent a result not far from the best attainable under the present general range of operating conditions, and the next significant advances in economy must wait upon some significant change in the latter, such as the advance to steam pressures of 600 lb. to 1000 lb. with some superheat, as noted in connection with the discussion on boilers.

INTERNAL-COMBUSTION ENGINES

The situation regarding internal-combustion engines has undergone no important change during the year. Such engines, especially of the Diesel type, are recognized as presenting very strong, even commanding, claims for consideration in the case of small or medium-size units, while they are quite removed from consideration for the case of large-size units such as those typical of present-day central-station service. The chief question of present importance relates to the boundary zone between those two fields. For units of a few hundred kilowatts rating and up to 1000 kw., and perhaps higher, the Diesel engine can demonstrate an over-all economic advantage. Beyond these limits the situation is less clear, and as the size of the unit advances into the thousands the Diesel engine rapidly loses its advantage as compared with steam turbo-units. The difference in the relative status of the Diesel engine in Europe and in America has often been noted. In Europe this engine has been definitely accepted to a far wider extent than on this side of the Atlantic. It is not too much, perhaps, to say that for moderate-size units, both for central-station service and for general power and industrial service, the Diesel engine is naturally accepted as normal and typical of good engineering practice, while in the United States the use of this type of prime mover is still considered as largely experimental, and such practice is far from being accepted as normal or typical.

With the increase in the number of responsible firms that are undertaking the manufacture of this engine in the United States and with the increasing experience which engineers are acquiring regarding the valuable features of the engine, and in particular regarding the features of reliability and durability, there should be a marked growth in the confidence with which this engine is viewed by the engineering public, and at least some approach toward the standing which the engine has achieved in European countries.

So long, however, as the relative costs of fuel and labor in this country and in Europe remain substantially at the present figures, so long will the economic point at which Diesel engines may be profitably employed differ accordingly; and while we may reach a condition in which the elements of durability and reliability will no longer be considered unknown or uncertain, it can scarcely be expected that we shall find it economical to use the Diesel engine quite to the same extent as in European countries.

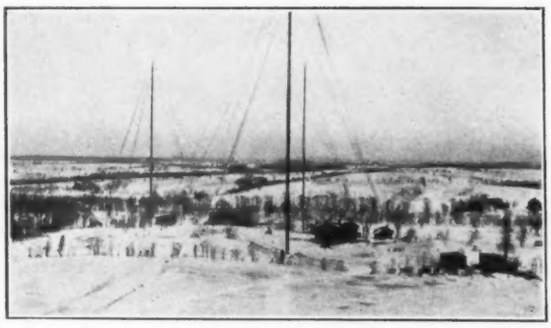
American engineers, however, will be well advised in examining very carefully the possibilities and the guarantees which reliable builders of Diesel engines are now able to offer them for any and all cases where power units in moderate sizes are required.

STATION DESIGN

In general station design no marked features or principles have developed during the year. Engineers are, however, finding themselves under an ever-increasing necessity of considering the problems of station design ultimately as economic in character and of reaching the final solution adopted in any particular case by way of economic studies. These phases of station design were well brought out in a paper by H. F. Parshall presented at the engineering congress in San Francisco, in the course of which he points out, among other things, that the amount of capital which can be profitably employed in realizing any specific economy is directly proportional to the number of hours in the year during which such economy may be made effective.

Further recognition is also noted, in recent design, of the fundamental principle of power-station economics that no stream of heat should be allowed to escape from a power house unless it be at a temperature too low to permit of economic salvage. Thus power and heating uses of steam in series are coming more and more into recognition; also internal-combustion engine exhausts are utilized for secondary heating purposes, such as warming water and keeping low steam in boilers, or for industrial purposes where available.

The central-station engineer cannot recognize too clearly the fact that his function is, in the last analysis, an economic one; that his duty is not only to transform potential sources of energy into other more available forms but to produce the largest possible product in exchange for a given over-all expense, and his selection of type and character of equipment and mode of operation must be made always with the economic factors in ultimate control.



Refinements in the Science and Art of Radio Communication

BY JOHN L. HOGAN, JR.
Chief Research Engineer National Electric Signaling Company

LIKE the year preceding, 1915 has seen a gradual improvement in the technique of radiotelegraphy rather than any radical change in apparatus or methods. For short-distance signaling, which is almost entirely confined to ship-to-ship and ship-and-shore telegraphy, new equipments embodying features of considerable practical value are displacing large numbers of older sets. Ship service is also being improved by the installation of storage-battery outfits to run the radio transmitters and to light portions of the ships in times of emergency; obviously such installations are great safeguards to shippers and the seagoing public.

An interesting tendency in radio design is toward provision for rapid change of signaling wave-lengths in sending as well as receiving stations. Heretofore it has been customary to set each transmitter for operation upon a single wave-length; recently the advantages of flexibility in wave-length selection have become more widely appreciated, and apparatus is now designed with that in view.

In spark transmitters multiple switches are arranged to change primary and secondary inductances in suitable amounts by a single motion; in receivers primary and secondary inductance or capacity are varied together, and thus the sets remain tuned over a large range of wave-lengths. By designating a single wave for calling and establishing communication between stations and by carrying on all exchange of messages on other wave-lengths chosen by agreement of the interlinked stations it is found that the early predictions of interference reduction may be realized. Such a traffic system as this has been adopted for official radio signaling, but it appears not entirely feasible for commercial ship wireless because of the unfortunate London Convention rules barring public-service radio from the important wave-length zone between 600 meters and 1600 meters.

Long-distance radiotelegraphy is tending more and more toward the use of sustained wave apparatus in place of spark transmitters. In fact, though it is still used in some important trans-ocean stations, the spark sender is considered out of date, and it is unlikely that spark-discharge oscillators will be greatly used in powerful installations. For short distances the quenched or rotary synchronous spark transmitter of high group frequency still retains great practical value on account of its economy and simplicity. For moderate powers the sustained-wave system seems likely to oust the grouped-wave method, and for high powers and long distances the recent conflict between these rivals has been definitely settled in favor of continuous waves. Dispute now exists, however, as to whether undamped radiation is best produced by the arc or the alternator.

RADIO COMMUNICATION WITH GERMANY

The European war has brought under close observation the operation of two pairs of transatlantic stations which afford the only direct communication between the United States and Germany. At both ends of one of these links—viz., Sayville and Nauen—sustained waves are produced by alternator and frequency transformer combinations, and the apparent ability of these installations to operate almost continuously has been considered weighty evidence in favor of machine generation. The distance of approximately 4000 miles is also covered with almost equal reliability (that is, fair communication except in times of atmospheric interference) by the Tuckerton and Eilvese stations. These are equipped with alternators, but at Tuckerton a powerful arc is used a large part of the time. The Navy Department appears to have concluded that arcs are preferable for its service, and it is purchasing generators of that type having input powers as great as 350 kw. for use at Pearl Harbor, the Philippines and San Diego. For the past two or three years the arc has given good results in commercial service between San Francisco and Honolulu, and it is now proposed to communicate directly between New York and Buenos Aires, 4600 miles, with arcs Installations of this type between Nova Scotia and Newcastle, England, however, were not successful, and an arc recently placed in the Eiffel Tower station is said not to be capable of the service anticipated. It is fair, therefore, to state that, although sustained-wave transmission is well proved to be superior to grouped-wave working, there is not sufficient information available to demonstrate whether the arc or the alternator may best be depended upon for commercial service. Undoubtedly much depends upon the design of the individual units of each type. Under many conditions powerful spark senders give satisfactory signaling over long distances. Glace Bay, N. S., and Clifden, Ireland, continue to operate commercially, and spark communication between San Francisco and Japan via Honolulu has lately been established. The Carnavon-New Brunswick transatlantic stations are still closed.

CONTINUOUS-WAVE TRANSMISSION

In considering the success of continuous waves it is most interesting to note that the reasons first advanced in their favor have not been entirely sustained by experience. While their use does permit of somewhat sharper tuning at receivers, by the use of looser couplings, this is not so marked an advantage as was claimed in some quarters. Neither has there been found the great decrease in absorption alleged in the arc-versus-spark controversy of some years ago. The unquestioned point of superiority lies in the effect produced *at the receiver*, when this is of the electrical beats or heterodyne type. To understand this condition it must be appreciated that the greatest remaining problem of the radio engineer is the elimination or reduction of atmospheric interference from "strays," and that, of all so far proposed, the method of probably the greatest proved value depends upon securing a musical signal tone which the receiving operator can easily distinguish from the irregular noises of atmospherics. One other method is of perhaps equal value. It consists in the use of a receiver which responds more strongly to feebly damped energy than to abrupt and highly decadent impulses such as those from strays. A high degree of such persistence selection is secured in the beats receiver, and, combined with a useful amplification, this is had whether the apparatus is used with grouped-wave or sustained-wave transmitters. When continuous waves are received, however, the phase relation of incoming energy remains such that the heterodyne produces signals of a pure musical character. In addition, the maximum of persistence selection is attained, and thus, since static disturbances are more nearly eliminated than in any other combination now used, the benefits secured from undamped waves become incontestable.

USE OF THE HETERODYNE RECEIVER

The use of heterodyne receivers has been vastly extended during the past year by the gradually spreading realization that three-element vacuum tubes may be used as radio-frequency relays, and therefore (on the humming-telephone principle) as oscillation generators as well as detectors. The surprising delicacy of these receivers is well known, and the simultaneous use of a single bulb as rectifier, amplifier and oscillator has already produced almost startling results in long-distance signaling under favorable conditions. In apparatus so employed the signals are produced by the conjoint effects of incoming and locally generated radio-frequency currents, and, as in any other heterodyne, musical signal tones are created. As would be expected, the great sensitiveness of the device makes its use subject to interruption by strays which would not affect seriously less delicate and consequently more reliable instruments. When atmospherics are at a minimum, however, vast distances may be covered by virtue of the great signal amplification obtained. It has recently been reported that Nauen, Germany, has been heard at Honolulu, Hawaii, a distance of some 9000 miles.

If success rewards the efforts to find an entirely new way to minimize the harmful effects of static interference, it will become possible to make practical use of the great magnifying properties of the relays already available. This will result in great saving of transmitter power consumption for long-distance radio, since at present the sending installations must be made many times more powerful than they need be for communication in the absence of static. Among the "atmospheric preventing" schemes which have been announced during 1915 is a loaded antenna for which, as a result of preliminary tests, much is claimed. This aerial system is understood to consist of a wire broken into sections by properly proportioned inductance coils and grounded through others in such a way that impulsive disturbances set it into vibration at frequencies other than that of the received signals. Other plans of corresponding interest have been proposed, but nearly all are awaiting demonstration under operating conditions.

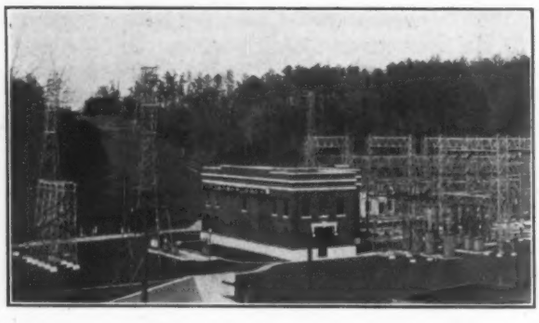
Little information is available as to the many uses of radio in the European war, though it is realized that by it, in combination with aeroplanes and airships, the principles formerly applied to scouting and fire control have been revolutionized. Communication with submarines, transmission of orders and reports along the extended firing lines of intrenched soldiers, and rapid exchange of information between temporary military posts are a few of the more important ways in which radio is aiding the belligerents.

RADIO LITIGATION IN THE UNITED STATES

Radiotelegraphy is also involved in a series of milder battles of another sort. Some twenty radio patents are in process of litigation in the federal courts of the United States, between nearly as many parties to the suits. The inventions involved range from improvements in receiving instruments to basic claims on tuning and even to high-frequency transmission itself. Decisions in many of the actions are awaited with considerable interest, since the highly complex patent situation of radio is in great need of being clarified. At the present time both patentees and alleged infringers are comparatively helpless, for until court actions sustain one or the other neither can proceed with security.

In more peaceful lines the activities of the Institute of Radio Engineers are worthy of note. This international organization was formed only three years ago by the coalition of the two oldest wireless societies, but now has a membership of more than 1000. The proceedings, committee reports and meetings (including those of the several sections) constitute a clearing house of modern progress in radio and are serving in no small way to spread the knowledge and create the interest which are essential in the growth of any new art.

Radiotelephony has in the past year begun to come into its own. The principles upon which work must be based have been realized for a long time, and many satisfactory accomplishments have been made in the past ten years. Many of the various practical problems have been solved day by day; the need of useful sustained-wave generators was met some years ago, but until recently it has not been possible to modulate these waves effectively at high powers. By the application of trigger vacuum-tube devices to the generators this end has been effected to a valuable degree, and within the past few months experimental demonstrations of radio transmission of speech from Arlington to San Francisco, San Diego, Panama, Paris and even Honolulu have been announced. These extreme distances are reached by the utilization of extremely delicate amplifying receivers in connection with the greater modulation of emitted power, and so are subject to interference from the almost ever-present atmospherics; nevertheless, the transmissions mark a tremendous step forward and serve as proof of the approach of a time when telephone lines may be interconnected with extensive radio links for distortion-free exchange of conversation.



Electrical Transmission and the Widening Use of Electric Service

BY DR. LOUIS BELL
Consulting Engineer

THE year's work in electrical power transmission may be described as intensive rather than extensive, involving a building up of load, extension of services, the growth of networks, and the working out of plans to improve continuity of service. There has been no sensational increase of transmission voltages, and, indeed, with the working limit already raised to the vicinity of 150,000 volts there seems no immediate occasion for such increase. The reliability of pressures from 100,000 volts to 150,000 volts, however, has been well tested by the year's work, so that when occasion requires there will be no hesitancy in pushing forward.

The distances of transmission established by the great Western systems have not been increased. It is, indeed, a little difficult to say just now what we mean by transmission distance except in the case of a nearly straight-away line. One seldom has to consider as an engineering or commercial problem the actual delivery of a considerable amount of power over a distance of two, three or more hundreds of miles. For in the development of transmission systems it usually happens that in covering a widely spreading district several plants co-operate, so that while in theory the network actually does reach a possible distance of transmission startling in its magnitude, as a matter of fact the combined plants in practice work over very conservative ranges. The longest united group of electrical transmission circuits is probably that which runs through the Southern Appalachian region and, in its various ramifications, begins not far from Wilmington, N. C., and stretches into western Tennessee, with numerous changes of ownership, many stations, and yet a practical continuity of metallic circuits which gives it standing as a transmission network in full extent nearer 1000 miles in length than 500. This group of systems has been of gradual growth from year to year and if fully utilized would exemplify the most generalized type of transmission system drawing its power from several watersheds and uniting their diversified resources for a common purpose.

Of course, in point of fact, such widely ramifying lines are practically not used as a unit, the connections being rather a convenience than an operating system and the line-carrying capacity not being great enough to permit, even could the stations deliver it, any considerable transmission from end to end. Opportunities for such joint use of power, however, exist on a very large scale, and it may be possible within a brief period for some connecting link to enable Niagara power to be delivered as far east as Providence, R. I., via some intervening independent systems. All this merely shows the trend of recent practice toward a fuller utilization of waterpowers. And this is but one of the lines along which progress in detail has been carried out.

SOLUTION OF OPERATING PROBLEMS

The complete system of regulation by synchronous condensers worked out in the Big Creek plant and now strengthened by experience after another year's operation is a type of the care being taken with the conditions of regulation in the larger transmission systems. The same interesting method has been adopted for the regulation of other and smaller plants in connection with older systems.

Another tendency which has been strong in the last year or so is the very extensive use of outdoor substations with the simplest sort of air-break switches, at first put into use in Southern and Western plants where climatic conditions are not severe. They are now being unhesitatingly used in Northern climates and have shown capability of so good service that the practice will undoubtedly grow. Occasionally a shelter roof is used in connection with such stations sufficient to protect somewhat against rain and snow, but more often it is merely a case of putting big transformers in the open, just as always is done with those on the distribution lines. There is really no more serious difficulty in keeping a 100-kw. unit with its necessary protective devices in the open air than in keeping a 10-kw. transformer of the same make on a pole in front of a factory and, save where special provisions for regulation or lightning protection have to be made, the walled-in substation seems to be decreasing in popularity.

The general practice seems to be to attempt to make the distribution system as simple and as nearly automatic in its operation as is practicable. These same tendencies pertain not only to the hydroelectric systems but to those great aggregations of distributing lines which are found in many places, particularly through the Middle West. More trust is steadily being put in automatic induction regulators and other automatic ap-

paratus for preserving uniformity of voltage, so that if the motor and lighting circuits at a given distributing point are kept separate, at least as regards the heavier units, substation regulation becomes practically automatic. Aside from refinements in service, the general methods of transmission by alternating currents are changing very slowly. Line structures, insulation, voltage and frequency are now fairly well standardized for ordinary conditions.

The storms of the past year have borne a serious lesson as to line design. The use of the suspension insulator, so important at high voltages, has resulted in towers upon which line strain works through the rather long lever arm necessary to keep the insulator chains clear of each other and of the tower, with the result that, while the towers are generally strong enough with respect to lateral and longitudinal stresses, they can be twisted to the buckling point with comparative ease. Some of the storms early in the year brought serious results in this way. The moral would seem to be a modification of tower design to lessen the twisting effort of the wires, and perhaps in addition more dependence on anchoring at considerable intervals upon very stable structures, leaving the rest of the system with more flexibility both as regards the supports themselves and the bearing of the wires upon them. The failure of the transmission line is so grave a matter that the subject is worth rather thorough study.

TENDENCY TOWARD A STANDARD FREQUENCY OF SIXTY CYCLES

It may be noted in passing that periodicity in transmission circuits is settling down more and more upon sixty cycles as the standard, except for such few systems as are devoted to operating alternating-current railway motors. There was a time when nearly everybody was talking low frequency on account of its supposed necessity in operating synchronous converters, and consequently a number of systems were quite unnecessarily burdened with a frequency at which the operation of incandescent lamps becomes exceedingly troublesome, particularly since the introduction of the metallic filament. Recent developments make it clear that some plants which adopted the lower frequency of twenty-five cycles per second may well now regret the lack of foresight. Systems like the great transmission from the Cedars plant on the St. Lawrence to Massina Springs, N. Y., point a moral which may well be taken to heart. This plant is of about 50,000 kva. The transmission is at sixty cycles at 110,000 volts, aluminum cables with steel core being used for the line conductors. The power is all utilized as direct current by means of a substation containing eighteen 2500-kw., sixty-cycle synchronous converters of commutating-pole type. The commutating pole and the general improvement in the design of big converters have put sixty-cycle operation on a firmly established basis of good practice. In such a plant as this, if anywhere, there would be plausible cause for going to twenty-five cycles on account of lessening the number of converter units, and especially because the output is practically for electrochemical purposes only. Unquestionably the sixty-cycle converter was originally rather tender, but the time has come when the use of such machines to convert energy for direct-current use cannot be fairly considered to imply low frequency.

Aside from this question of frequency, there has been an interesting development of synchronous-converter practice in the establishment of automatic substations for electric-railway service, one excellent example having already been worked out on a line near Chicago. In this case three automatic substations have been put in use in which the synchronous converters are started and stopped automatically in response to load conditions, thus freeing the transmission system from the considerable burden of having operators constantly on duty at the substations and keeping the stations running, as is usually done, through the periods of light load. The results so far seem to have been favorable, but it will take considerable experience before that general confidence will be established in the practice which will bring it into widespread use. It certainly is a long step forward to be able to supply a direct-current trolley line from alternating-current feeders without substation attendance. It seems evident that a considerable extension of the automatic principle, whether involving synchronous converters or not, could be applied with advantage of many distribution systems. Automatic apparatus, always looked at a little askance by the conservative operating engineer, has been steadily made more reliable. It deserves a wider place than has yet been accorded to it. It is quite obvious that regulating stations with synchronous condensers could be worked out in precisely similar fashion so as to relieve some of the difficulties which now exist in supplying power and light from branches on long systems, and the same scheme may prove useful in automatically adjusting the feeding of current for auxiliary interchange between one system and another.

Another feature of transmission practice which has shown material growth in the last year is the transmission of power from cheap coal supply, the most distinguished recent example of which is the Cabin Creek plant, described in the ELECTRICAL WORLD of July 31 and Aug. 7, which is actually a coal-operated transmission system supplying power to a big group of coal mines in the famous West Virginia fields. To obtain power from the cheap coal at the mouth of the mine and be able to transmit it over long lines at high voltage for use at other mines is a feat in economic engineering worthy of a conspicuous place in an account of recent progress. The same sort of thing will unquestionably grow in importance and must be regarded merely as an extreme case of the transmission from steam stations which had already justified itself in several Southwestern plants.

THE INITIAL 3000-VOLT DIRECT-CURRENT RAILWAY

Perhaps the most striking feat of the year, however, has been the putting into experimental operation of the very notable 3000-volt direct-current railway transmission on the Chicago, Milwaukee & St. Paul Railway, an enterprise the fruition of which will probably come within the view of next year's report of progress. The locomotives built for this purpose are very remarkable from the standpoint of electric traction, to which field the description of them properly belongs. Suffice it here to say that they are of unprecedented hauling power, of the articulated type, with eight motors per locomotive, each having a continuous service rating of 375 hp. It is remarkable enough that the locomotive should have been successfully designed for this great output, but the feature of most importance from the point of view of electrical transmission is that the motors are arranged in pairs to operate in series at 3000 volts on the trolley wire, each motor being, therefore, wound for 1500 volts. This most notable achievement has a profound bearing on the question of design of distribution systems for traction purposes. A working pressure of 3000 volts is enough to require a recasting of the comparisons which have customarily been made between direct-current and alternating-current traction systems. In working on the scale demanded for trunk-line operation, and with unit motors of the size here employed, the difficulties of direct-current construction for high voltage, as found in ordinary electric-traction problems, are greatly ameliorated. There is

no reason to suppose that with machines of such size 1500 volts per motor is to be considered as the limit. Observation of the high-voltage construction carried out by M. Thury in Switzerland makes it perfectly plain that we may reasonably look forward, at least so far as locomotive practice is concerned, to doubling the voltage here mentioned, while still retaining good commutating conditions. The higher the voltage on the working conductor the fewer difficulties will be experienced in collecting the current, and if some skillful engineer has the courage of his convictions and combines such a system with the installation of entirely or substantially automatic substations, the net efficiency between generator terminals and working motors will rise to a figure which will give a new impetus to heavy electric traction. If one were to single out the transmission achievement of the past year which gives the greatest promise of fruitfulness in the general advance of the art, his choice would certainly have to fall on this great increase in the working possibilities of direct-current distribution for traction, an advance quite as significant as the notable rise in general transmission voltage which followed the introduction of the suspension insulator.

The Place of Electrochemistry in the Arts of War and Peace

By E. F. Roeber

Editor *Metallurgical and Chemical Engineering*

THE American chemist has been much in the limelight during the past year. What no amount of lecturing could have done the European war has accomplished—the American public at large now understands that chemistry is a great deal more than a string of drug stores and that the whole industrial life of the nation depends in many ways on the work of the chemist. Unfortunately, but perhaps naturally, this better understanding of the scope of chemistry has come so suddenly as to cause serious misunderstandings and most unjust criticisms of the American chemist.

The present war has been called a chemical war, because its physical violence has been rendered possible chiefly by chemical science. But the chemist should not be blamed on this account. The chemical inventor never knows to what different purposes his inventions may finally be put. As Dr. L. H. Baekeland pointed out in his address before the American Chemical Society in Seattle last autumn, the chemist should not be reproached for the fact that nitrocellulose, of which the first application was to heal wounds and to advance the art of photography, was stolen away from these ultrapacific purposes for making smokeless powder and for loading torpedoes. Nor should the chemist be blamed because phenol, which revolutionized surgery, turned from a blessing to humanity into a fearful explosive after it had been discovered that nitration changes it into picric acid. "Science and religion have this in common, that their noble aims, their power for good, have often with wrong men deteriorated into a boomerang to the human race. Our very successes will threaten to devour us as long as all of us have not yet become imbued with the truth that greater knowledge, like greater possession of wealth and power, demands a greater feeling of responsibility, greater virtues, higher aims, better men."

The Chemical Engineer and the Financier

In a narrower field and in a much narrower spirit the American chemist has been bitterly criticised on account of the lack of a complete American dyestuff industry. But the attacks made on this account by the newspapers on the "spunk" and ability of the American chemist were addressed to the wrong party. The American textile industry and aniline-dye consumers in general could have had all the dyes they needed and the fullest support of American chemistry if the consumer had been willing to invest the necessary capital for such an industry under unfavorable economic conditions in competition with the highly organized German dyestuff industry. Why should the industrial chemist of America have turned just to this special field when there were so many other big fields open for development which promised very much better returns for the invested capital? Common sense should make it obvious that chemical ability alone can do little if it is not backed up by the financier. In spite of all this, when the lack of dyestuffs became an industrial calamity in this country, almost at the start of the war, the American chemist was quick to see his duty and to do it. He quietly went his way and started things, many things. More aniline dyees are now being produced, and very much greater quantities, than ever before in this country; and this development is steadily going on. During the last weeks of the year the news came of the erection of the first artificial indigo factory. The American chemist has done and is doing his duty. The only question is now: Shall these new American industries be permitted to grow after the war until they are firmly and permanently established? There is an absolute consensus of opinion among those familiar with the facts that these new industries created under such special conditions can be made permanent only if, besides the enactment of an anti-dumping law, a protective tariff is imposed for a sufficiently long time. The decision as to the ultimate outcome rests not with the American chemist but with the American people and its representatives in Congress.

How unfair those newspaper criticisms of the American chemist were is manifest when we consider that for the sake of the attack a comparatively small special field of chemical activity was singled out and all the really brilliant and highly successful work of the American chemist was forgotten. As those plants grow best which are best adapted to the soil, those branches of an industry are most successful which conform most closely to the local conditions of a country, such as natural resources and market conditions, and to the psychology of the nation. Of industrial chemistry no other branch is so distinctly American in origin and evolution as the electrochemical industry. And the economic importance of electrochemical products was not exaggerated in the least by F. A. Lidbury when in his presidential address before the American Electrochemical Society last year he said that, in spite of the youth of the American electrochemical industry, its absence at the present time from among the industries of the country would cause such industrial disturbance that the plaint of the wearer of many colors, always

imminent, but not up to the present moment audible, would pass unnoticed.

ELECTROCHEMICAL INDUSTRIES BUSY

The old-established electrochemical industries of this country, with Niagara Falls as headquarters, are in a very prosperous condition, though they are being seriously affected by the power shortage at Niagara. The war has had the same effect on these industries as a very high tariff would have, cutting off imports and foreign competition. This effect is well reflected by the present price of aluminum, the consumption of which in automobile and aeroplane construction and in steel manufacture has greatly increased. The activity in the iron and steel industry has also resulted in a whole carbide factory being turned over to ferro-silicon manufacture. More electric steel furnaces have been installed during the past year than ever before, and naturally this has been of great benefit to the artificial graphite and amorphous carbon electrode industries. Cyanamide production is increasing. While in the electrolytic production of caustic soda and chlorine the weak end commercially was formerly chlorine, this is no longer the case since the importations of foreign bleach have stopped. And so we could go through the whole list of electrochemical products. It would be always the same story of well-deserved prosperity.

Only one more example, however, must suffice—that of artificial abrasives—because in the mind of the general public they are hardly connected with electrochemistry, while their industrial importance is certainly not appreciated in general. The output of abrasives, made in electric furnaces by the two Niagara manufacturers, was not much short of 20,000 tons in 1915 (including both alumina abrasives and silicon carbide), and their value may be conservatively estimated as $2,000,000. Where does this output go to? Of course, largely into the iron and steel industry. But it is not generally realized to what extent abrasives enter into the equipment of the modern machine shop. Hardly an essential in our daily walks of life but is dependent on this new machine tool for its manufacture. As L. E. Saunders once said, the breakfast food with which we start the day, the stove on which it is prepared, the morning paper which gives it flavor, the street car, railroad train or motor car which takes us to business, the mahogany and plate-glass panels in our palatial offices, the typewriters which write our letters, the pearl buttons on our gloves, the leather gloves themselves, nearly all our activities, and finally the polished granite columns at our graves, would not be here in their present perfection were it not for the artificial abrasive which either makes an integral part or a machine to accomplish the end in view.

ELECTROMETALLURGY OF STEEL AND ZINC

In electrometallurgy great progress has been made during the past year chiefly with steel and zinc. In the enormous prosperity of the steel trade the electric steel furnace has had its proper share, while in zinc metallurgy, as a result of the very high prices for very pure zinc for war purposes, electrolytic zinc has come to the front with surprising rapidity. Perhaps this is not so surprising after all as the fact that the electric zinc furnace has had no share in this prosperity.

The whole status of the American electrochemical industries is so satisfactory, so healthy and substantial as to be a matter of just pride to the whole chemical profession. Nor is the deserved recognition lacking. It is hardly accidental that among twenty-two members of the Naval Consulting Board, elected by eleven national engineering societies, there are three past-presidents of the American Electrochemical Society, its present president, and one past-chairman of its New York Section. And it may be sincerely hoped that the American nation as a whole will appreciate more and more keenly the eternal truth of the following words which Thomas P. Smith spoke almost 127 years ago before the Chemical Society of Philadelphia on April 11, 1789: "The only true bases on which the independence of our country can rest are agriculture and manufacture. To the promotion of these nothing tends to a higher degree than chemistry."

Progress in Illuminants and Illuminating Engineering

BY PRESTON S. MILLAR
General Manager Electrical Testing Laboratories

THE outstanding features of the past year in the field of illumination are the progress made by the gas-filled tungsten lamp and the extension of exterior lighting, of which the highest expression is to be found in the lighting of the Panama-Pacific International Exposition. Each of these developments appears to be a significant beginning which presages further large extension of artificial lighting.

A brief review of these and other features of the 1915 record will be facilitated by considering in turn illuminants, lighting accessories, lighting practice and photometry.

PROGRESS IN ILLUMINANTS

At the end of the year the metallized-filament lamp appears as the only survivor of the carbon-lamp class, and the demand for this type has fallen to something like 5 per cent of the total demand for incandescent lamps.

In the tungsten-lamp class there has been added to the sizes of "Mazda" vacuum lamps previously available the 7.5-watt multiple sign lamp, and there have been eliminated all multiple vacuum lamps larger than 100 watts and all street series lamps of the 3.5-amp. and 4-amp. classes, as well as the 32-cp. and 40-cp. sizes in lamps of other current values. As the year closes the new 50-watt size Mazda lamp makes its appearance with every prospect of becoming a standard and much-used size.

Vacuum lamps having concentrated tungsten filaments have been made available in 25-watt, 40-watt and 60-watt sizes. These are recognized as possessing little or no advantage over similar lamps having filaments disposed in the usual way, while their life performance is distinctly inferior. They are made to meet a demand arising out of the novelty of their construction.

There has been no increase in the efficiency of Mazda vacuum lamps. The rating has been improved, however, and the lamps are now manufactured more accurately and more consistently than any incandescent-lamp product which was ever before available.

The gas-filled tungsten-filament type has been extended to include several sizes and classes not formerly available. In the Mazda C lamps the more notable extensions have included series lamps, where all are now of the gas-filled type; the 100-watt multiple lamp, and several sizes of lamps for special service such as automobile headlamps and stereopticon lamps. Re-design of the bulb with some other adaptations has brought improved performance throughout life. The efficiencies of such Mazda lamps have been increased by from 15 to 20 per cent, the largest increases being experienced in the 100-watt and 200-watt sizes, in which argon is now used with nitrogen. A special blue-bulb multiple Mazda C lamp has met with considerable success in store lighting and photography, where the closer approach to white light is appreciated.

The problem of the successful operation of tungsten gas-filled lamps on direct-current series circuits has not yet been entirely solved, though progress has been recorded.

In all forms of Mazda C lamps the horizontal candle-power rating has now been abandoned in favor of the mean spherical candle-power or total lumens.

DEVELOPMENTS IN ARC LAMPS

The flaming-arc lamp has been developed during the year principally for special purposes, including a white-light carbon electrode especially adapted for use in photography and in those kinds of commercial and industrial work where a closer approach to daylight is esteemed important.

The magnetite-arc lamp has undergone certain developments which result in improved efficiency and greater flexibility. A flat electrode for 4-amp. service has been devised which permits a lower arc voltage adjustment and a lower wattage per lamp without material decrease in illuminating value. The 5-amp. lamp is now entirely standardized. A "high-efficiency" electrode for the 6.6-amp. lamp has been perfected. Redesign has brought about standardization of construction common to all three current values with increased conservation of the light from the arc.

Among tube lamps, improved power-factor in alternating-current mercury-vapor lamps and a new form with renewable tube for the Moore carbon-dioxide lamp have been the principal developments.

The principal advances to be recorded among accessories are the further development of the prismatic refractor for street lighting, the improvement in projectors for employment with Mazda C lamps in flood-lighting, etc., and numerous additions to the list of decorative shades, globes, reflectors and fixtures for interior lighting.

LIGHTING PRACTICE

The most notable development of the year in lighting practice appears to be extension of the use of light in exterior work, especially in the lighting of building exteriors and in lighting for recreation purposes. The successful development of the tungsten gas-filled lamp has been largely responsible for opening up this new field of lighting activity. Flood-lighting of buildings has considerable advertising and esthetic value, while the extension to night-time of forms of recreation heretofore limited to daylight hours has made a strong appeal to many people. In both respects practice appears to be in the formative stage, and in line for considerable further development.

The lighting of the Panama-Pacific International Exposition, referred to in the first paragraph, has served as a notable object lesson, illustrating in a most striking way the potentialities of exterior lighting, offering inspiration to architects and illuminating engineers and suggestion for extension work to the electrical industry as a whole.

In interior lighting no very notable developments or radical departures from earlier practice have been recorded. Everywhere the employment of higher intensities of illumination and greater attention to the securing of pleasing lighting effects appear to have followed the reduction in the cost of light and the advance in the art of illumination which have characterized the past few years.

The substitution of tungsten-filament for carbon-filament lamps in former years has resulted in some undesirable lighting conditions due to the increased filament brightness of the newer lamps. The introduction during the past year of concentrated-filament vacuum-type lamps and of gas-filled lamps in small sizes has in such instances made a bad condition worse, and the use of excessively bright sources without proper protection has come to be a real lighting evil. Progress made during the past year in the replacement of old fixtures and glassware was not sufficiently rapid to cope with this growing difficulty.

In street lighting the tungsten gas-filled lamp and the magnetite-arc lamp emerge as the principal modern illuminants. The Mazda gas-filled lamps especially have been employed in the replacement of inclosed-arc lamps. With both illuminants the refractor has been employed successfully, while with the Mazda gas-filled lamp the use of the diffusing globe has been general practice except in the smaller sizes. The substitution of Mazda lamps for carbon-inclosed arc lamps has usually resulted in dividing the benefit by securing to municipalities increased illumination at a less price. Too often the substitution has been made without relocation of lamps or improvement in mounting which might have been realized at the time of replacement. The installation of "white-way" lighting in smaller cities and towns continues to offer notable and stimulating improvement in street lighting. In such installations the use of clusters of lamps has very largely given place to the employment of single illuminants of either the incandescent or arc type in ornamental mountings.

Automobile lighting during the year became almost exclusively lighting by tungsten-filament lamps. The artificial lighting of photographic studios, including motion-picture studios, using one or more of the several varieties of suitable electric lamps, constituted an additional notable development. The use of the incandescent lamp for several other specialties, including miniature lamps for use on dry batteries, likewise warrants mention.

The impetus given to better lighting through commercial agencies was continued during the year. Manufacturers through their engineering departments and bulletins, and central stations through their illuminating engineering departments and through attention to the use of good lamps suitable for the service, must once more be recorded as potent factors in the improvement of artificial lighting. The Illuminating Engineering Society produced during the year a "Code of Factory Lighting" and continued its general campaign for the improvement of illumination.

PHOTOMETRY

In the realm of photometry there have been some notable developments. The variability of light distribution among Mazda C lamps, the variation in spherical reduction factor of these lamps throughout life, and the effect on the distribution characteristic of the shape of clear-glass bulbs have combined to make imperative a rating on the basis of total flux. The integrating sphere has come to be recognized as the generally accepted appliance for photometry in this field. Practically all lamp manu-

facturers during the past year installed integrating-sphere photometers, and all their lamp-standardization ratings are now based upon measurements with this instrument. The integrating sphere has also been used successfully in the street for photometry of arc lamps.

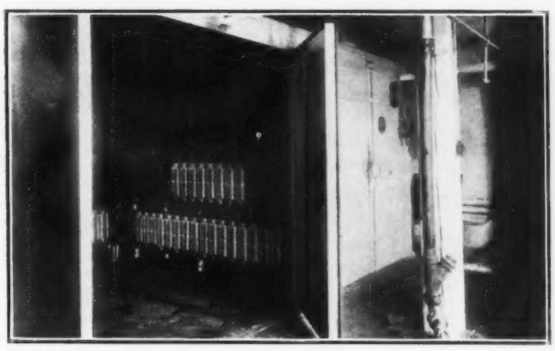
The standardization and calibration of color filters have received much attention, and progress has been made during the past year in this important phase of heterochromatic photometry. Work has progressed also upon physical photometers, and this substitute for the human eye in photometry has now attained a position where it is being experimented with in commercial work.

In illumination photometry the development of a compensated test plate to avoid errors due to departure of the test plate from the cosine law has been a most notable feature.

In the matter of units and nomenclature some advance may be recorded. In the adoption of the lambert (or millilambert) as the unit of brightness an important gap in the list of units has been filled.

International co-operation in illumination matters is, of course, at a standstill. Nevertheless, the United States national committee of the International Commission on Illumination maintains its organization and looks forward to taking the initiative in restoring international harmony in illumination affairs after the end of the war.

In conclusion, the past year has not been marked by any radical developments in illuminating engineering. It has been characterized by important extensions of activities along the lines previously indicated and by a continuance of effort on the part of the several agencies whose combined activities are rapidly advancing the art of illumination. Such progress in directions previously determined has been important and gratifying.



The Basis for Present and Future Growth in Electric Heating

BY W. S. HADAWAY
Electric Heating Engineer

IN considering electric heating there are certain fundamental facts which must be recognized more fully before electricity takes its true place in the heating industry.

Heat at low temperatures can be obtained by other means independent of electricity, at a cost of about 0.1 cent per kilowatt-hour heat equivalent (3412 B.t.u.).

The low-temperature heat required for both domestic and industrial purposes is much greater than the high-temperature heat required. For example, in cooking, more than two-thirds of the total demand is for low-temperature heat.

Electricity is well adapted for producing heat at high temperatures and can successfully compete with heat produced in other ways. Furthermore, electricity has the great advantage of being particularly easy to control and regulate.

An enormous field, which is as yet practically undeveloped, is open for electricity to supply the high-temperature heat in conjunction with other heating means which are better fitted to supply low-temperature heat, the working level from which the electricity acts being elevated to an economic plane and the range of temperature demanded from the electric heater materially reduced.

The central-station industry should not be expected to reduce its rates to cover the entire field of heating at all temperatures, but should be urged to promote the application of electric heating to the field for which it is best adapted and in which it can be used with profit both to the central station and to the consumer.

ELECTRIC-HEATING SPECIALTIES

The goods made by the hollow-ware manufacturers formerly centered around the alcohol lamp. Many of them have now adapted the electric heater to their lines and added some distinctively electrical appliances, such as toasters and table stoves.

The alcohol lamp has always been an unimportant factor in the broad economics of heating; the equivalent electrically heated utensils will find a somewhat wider, though essentially a restricted, field. While these devices bring the electric heater into the home and popularize it, and while large numbers are sold, they tend to specialize rather than generalize the electrical service.

The very great prominence given this class of goods by the electrical industry leaves the impression that the limits of economical heating service from the central stations are very narrow. Insufficient emphasis is given to the fact that lamp-socket heating conveniences have a relation to the broader heating problems similar to that of lamp-socket motors in the power industry.

INCREASE IN USE OF ELECTRICITY FOR COOKING

The rapidly growing use of electric ranges in the kitchens of institutions and apartment houses is a noteworthy achievement. These installations are in effect heating substations. The range is the high-temperature part of the equipment, and the steam or hot-water service cares for the low-temperature work.

Now that the electrical method of cooking is firmly established under special conditions, the next great step will be the further reduction of operating costs so as to bring the apparatus into general use. Where a steam or hot-water service is available it is unnecessary to use electrical apparatus at temperatures below that of the low-temperature service.

Saturated water vapor at atmospheric pressure gives a temperature level of 212 deg. Fahr. for electricity to work from, instead of the room temperature of 70 deg. Fahr. or 142 deg. Fahr. higher. Low-temperature heat is comparatively cheap, costing from 0.05 cent to 0.25 cent per kilowatt-hour heat equivalent. More than two-thirds of the heat required in cooking, both directly and in secondary operations, is at the low-temperature level. The electrical service is an economical source for the remainder at prices varying from 3 cents to 5 cents per kilowatt-hour.

It is obvious that the central station cannot compete with fuel at the low-temperature level; it is equally obvious that it can supply the remainder of the heat required at profitable power rates. The establishment of temperature levels is a vital point in electric-heating development. A temperature level can readily be secured for cooking over three times as great as that upon which agriculture depends with its annual production of billions of dollars in wealth!

An interesting paper showing the merits of the electric oven was presented at the last annual convention of the American Institute of Electrical Engineers. The relation of time and temperature in baking was carefully analyzed. The precision with which electric-cooking apparatus works will undoubtedly bring new methods of manipulation and materially add to its value in domestic science.

Gas and electric cooking apparatus share in common the need of auxiliary low-temperature service. Electricity has a great advantage over gas in that it can do all its work above the low-temperature level, that is, it is readily confined to a more specific high-temperature use than gas and hence is more economical.

The kitchen offers an enormous field for electrical apparatus. Present electric-range designs are better fitted for special than general use. When broader conceptions of the purpose of electricity in heating prevail better results can be realized. The electric-heating designer makes his apparatus exclusive by aiming to make it inclusive; the reverse method will make it well-nigh universal.

INDUSTRIAL ELECTRIC HEATING

Industrial electric heating was founded upon the basis that while other forms of heat are cheaper than electricity at low temperatures, the two sources of heat used together make a combination which can be equaled in no other way. Conservation of heat energy is of even greater importance in electric heating than in any other direction.

Considerable prominence has recently been given to several large equipments of japanning and enameling ovens, and the results confirm the value of a high-temperature oven heater which is free from combustion products. This application, however, which not only requires relatively high temperatures but large quantities of heat as well, is a striking example of what can be accomplished by using a temperature level for the electric heaters to work from equivalent to that of the lowest temperature wanted.

These plants are situated near the bituminous coal fields where fuel is cheap. More than one-half of the required heat could be secured at a cost of less than 0.10 cent per kilowatt-hour heat equivalent. The central stations could supply the rest of the heat at more profit to themselves and with a saving to customers.

Tabulations of collateral advantages are impressive and have an important bearing upon factory costs; but if the running cost is dearer than that with other methods, these appear as apologies rather than as advantages. The big things which electricity has made possible have saved money directly, and the other advantages, important as they really are, have still been rated of minor value in the long run.

Temperature control is a distinctive requirement of industrial heating. That is, the heater should function through a definite cycle automatically. This is well illustrated in the crucible of the linotype machine, which is in effect a miniature type foundry. Accuracy in control, sanitary conditions, reduction of stray heat losses, coupled with more and better work at a less running cost, are improvements accomplished by the electric-heating equipment.

The formation of the Industrial Electric Heating Association during the past year evidences the importance of this branch of electric heating. The annual meeting was recently held, and the subjects discussed related chiefly to the metal trades such as enameling ovens and melting furnaces.

Reference has already been made to the way cooking and industrial heating can be broadly adapted to central-station conditions. Another example will show the application of a similar method to room heating on a relatively large scale.

Ventilation, humidification and warmth are the three requisites in room heating and hygiene. Closeness or vitiation of the air comes from stagnation or stratification more than from increase in the carbonic-acid content. Vigorous stirring of the air with some replenishment is equivalent to complete change of warmed air as in plenum systems, and the total heat requirement is lessened. The electric fan is available for stirring the air and diffusing its warmth.

When the air is properly conditioned by humidification its temperature may be lowered several degrees. It not only costs less for heat when the humidity is right, but the hygienic conditions are much better. One pound of fuel burned with electric control produces 4 kw.-hr. heat equivalent. At 3 cents per kilowatt-hour the electricity used costs 1.5 cents, and the fuel cost is assumed to be 0.25 cent ($5 per ton average). The total heat energy therefore costs at the rate of 0.45 cent approximately per kilowatt-hour heat equivalent.

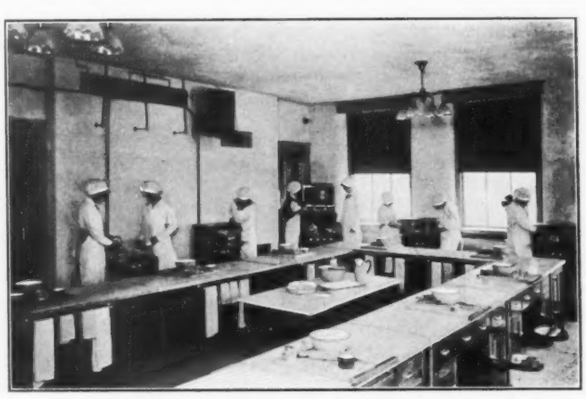
Electricity is not expected to supply the air for ventilation nor the water for humidification. It controls the things which already exist. Electricity is a fuel in only a limited sense; it is rather a service—an impersonal servant of almost infinite capacity. As such, among other things, it controls combustion, which gives heat; it moves the air, which gives ventilation, and it controls vaporization of water, which makes the air moist.

RATES FOR ELECTRIC-HEATING SERVICE

The trend of the electric-heating industry has been to depress central-station rates by representing that the business would expand rapidly if the cost of power were low enough. The electric-heater improves the diversity factor and is consequently entitled to favorable consideration in rate adjustments.

It can readily be shown, however, that the central station, even under the most favorable general conditions, cannot compete with low-temperature heat service. It is therefore desirable for heating engineers to build their work up to a level which will make it feasible for the central station to sell heating service at rates equivalent to those regularly obtained from power supply of similar characteristics.

Before heating rates can be finally adjusted, therefore, the electric-heating engineer needs to broaden his designs and raise the temperature base line from which he works. Central stations will gradually lower rates as diversification and load increase. A satisfactory point will thus ultimately be reached without the necessity for special heating rates. Electric-heating installations will therefore bear their proper percentage of overhead burden and become one of the most desirable as well as the biggest of load builders.



Electrical Organizations in 1915 and 1916

The Year Ahead, as Seen by the Representatives of the National, Engineering and Commercial Organizations Within the Industry—Statements Which Suggest How Mutual Co-operation Will Advance the Industry as a Whole

"In the increasing complexities of modern development, both civil and military, the A. I. E. E. has come to be recognized by the state and national authorities as the representative body of electrical engineers, and it is called upon from time to time to take action in matters of great public importance."—J. J. CARTY.

The Outlook for the Work of the A. I. E. E.

BY J. J. CARTY

President American Institute of Electrical Engineers

THE outlook for the American Institute of Electrical Engineers never seemed brighter than at present. The June convention, held in the East, at Deer Park, Md., and the Panama-Pacific convention, held on the Pacific Coast, at San Francisco, in September, during the Exposition, were both fully attended. They brought together our members from all parts of the United States and Canada and splendidly emphasized the national character of our society.

At these conventions valuable papers were read and fully discussed, and in addition to this, owing to the excellent management of the committees in charge, the members and their families were provided with various forms of entertainment, which afforded opportunities for making those personal acquaintances which are such a valuable by-product of national conventions and which contribute so much to harmonious working in a society whose members are distributed over such a vast area as ours.

The participation of the Institute in the International Engineering Congress held in San Francisco last September indicates the international character of its sympathies. The success of this international congress, which was due to the co-operation of the Institute with the other great national engineering bodies, is a splendid example of what can be accomplished for engineering as a whole whenever the circumstances permit these great societies to act in concert.

DIVERSIFIED ACTIVITIES OF THE INSTITUTE

The activities of the Institute are manifold and cover all branches of electrical engineering, which are represented by committees composed of the leading engineers in their respective departments.

In the increasing complexities of modern development, both civil and military, the Institute has come to be recognized by the state and national authorities as the representative body of electrical engineers in this country, and it is called upon from time to time to take action in many ways relating to matters of great public importance in different states in the Union and by the national government itself. Recently, upon the request of the Secretary of the Navy, the institute designated two of its members for appointment upon the Naval Consulting Board, and upon another occasion it appointed a committee to co-operate with the War Department in matters pertaining to the national defense.

So important has the work of the Institute become that it is now recognized that every young man seeking for a career in electrical engineering should qualify himself, as soon as practicable, to become enrolled in its membership, and for the encouragement of such young men branches have been established in our universities, so that students may be enrolled during the time of their college studies and subsequently become members. The usefulness of these branches has been so widely recognized that from less than six in 1902 they have grown to more than fifty at the close of 1915.

LOCAL SECTIONS EMPHASIZE NATIONAL CHARACTER OF INSTITUTE

To extend still further the usefulness of the Institute and to emphasize thoroughly its national character, sections were started in the principal cities of the country. The work of these sections became so important that they have now been established in all parts of the United States, increasing from five in 1902 to more than thirty in 1915.

The American Institute of Electrical Engineers stands for the highest achievement in electrical engineering and for the most distinguished attainments among its members.

From the art of electrical engineering as it stands in the world to-day take away the contributions of the members of the American Institute of Electrical Engineers, and that which would be left would make a sorry showing by comparison.

The art of telephony would disappear, and all of those wonderfully co-ordinated activities of both peace and war depending upon that means of communication would instantly be paralyzed.

In electric lighting and energy distribution for all purposes the contributions of our members have been so fundamental, so important and so numerous that it is difficult to picture the chaos which would result if, by some magic, their wonderful work could be undone.

By its papers and meetings and discussions, by the spread of knowledge through its published *Proceedings* and *Transactions*, and, above all, by the high ideals of its members and by the unsurpassed character of their

achievements, the Institute has taken a foremost place among the forces making for the welfare and unity of our country.

"The industry is passing into a new epoch which will require the closest attention and highest ability in order that we shall not suffer in any way in our development."—E. W. LLOYD.

The Closer Union of the Industry Through the N. E. L. A.

BY E. W. LLOYD
President National Electric Light Association

DURING the past year necessity for economy in operation and in expenditures of capital has been brought home very forcibly to central-station operators. To the credit of the industry, it can be said fairly that economies have been made which have resulted in maintaining the high standard of service established in the past, and at the same time investors in our securities have continued to receive returns on a satisfactory basis.

The situation has brought to our attention the necessity for closer co-operation inside of the industry, and as a consequence has shown the value of our organization and the possibility of expanding its usefulness.

Over a period of years the National Electric Light Association has compiled valuable data which have been spread broadcast, with the result that the efficiency of the business has reached a very high plane.

CLOSER UNION BETWEEN ASSOCIATION AND MEMBERS

In order to continue this education, it must be evident that a still closer union should prevail between the individual members of all classes and the association. Owing to the fact that commissions have come into existence in the large majority of states during the last five years, our business has been compelled to readjust itself. In many instances these new conditions have resulted in the enactment of legislation pertaining to our business. This seems, therefore, to call for greater activities in the national association in order to protect properly both the public and our rapidly expanding industry.

Member companies need advice covering the valuation of their properties and proper legislation by the federal, state and municipal governments. The first step to accomplish this seems to be to divide the country into state and geographical sections, depending on the density of population. Already some results have been obtained in this direction, and there is no question that in the next few years all of the existing state associations not affiliated with the N. E. L. A. will join our ranks. Eventually these sections will consider all local problems at their annual conventions, leaving for the main body the interstate and national questions. The meetings of the national association might be attended by elected delegates from the sections. Furthermore, the subdivisions into sections such as now exist—namely, Commercial, Accounting, Technical and Hydro-Electric—and possibly that of our manufacturing members, together with the affiliation of existing organizations outside of the N. E. L. A., would lend great strength and would interest more brains in our activities.

It would seem as if the above combination, with a fixed policy over a period of years, would result in great good to the electrical industry. The N. E. L. A. is the logical body through which large work can be accomplished, and there seems to be no doubt that the industry is passing into a new epoch which will require the closest attention and highest ability in order that we shall not suffer in any way in our development.

PROBLEMS BEFORE THE INDUSTRY

A great many problems need attention at the present time. Some of them are receiving individual investigation in different sections of the country. This should not be. There should be a united effort which would result in greater good to all than can be obtained through the efforts of any smaller aggregation.

Sections of the association should be formed wherever necessary to cover every branch of the industry not now covered. Some progress has been made in this direction and, if we complete our affiliation with the Electric Vehicle Association of America, excellent results will have been accomplished, particularly as we have been fortunate in being able to change our constitution in order to form new sections, embodied under the titles of Technical and Hydroelectric Section and Manufacturers' Section. The latter, we trust, will be in active working condition before the next national convention.

Perhaps the individual will wonder how the N. E. L. A. can best serve his interests. The information available to any young man in our industry through close study of the proceedings and activities of the association would undoubtedly give such a man a liberal education that could be secured in no other way. Any men seeking advancement to higher positions in our business can accomplish the result better through affiliation and study of the association work. In fact, it is doubtful if they can accomplish their purpose without such an affiliation.

So far as the man farther down the line is concerned, if he wishes to make the central-station business his life work (and considering its very prosperous growth during the last ten years, there is no reason why a man should not seek such a connection), then if he cannot see that his best interests are served by affiliating with us and that his annual contribution is not to be considered merely as purchasing a volume of *Proceedings* but as a contribution toward a compilation of facts and data which always results in higher general efficiency and might result in actual protection of our business against unjust legislation, that man has not reached the point where he thoroughly understands how to protect his best interests.

What could be more beneficial to the business than a well-organized body such as is suggested above where members of all classes have a reciprocal interest in its prosperity?

"Electrical contractors have learned that the way to get business is to look for it in the places where it is to be found, and to keep steadily at the work of building up new customers."—JOHN R. GALLOWAY.

"We are beginning to see in clearer proportion the tremendous development that lies ahead. In this development the electric industry will play a notable part."—ALAN SULLIVAN.

Better Merchandising a Keynote in Contractors' Plans

BY JOHN R. GALLOWAY
President National Electrical Contractors' Association

THE era of prosperity dawned during the closing months of 1915. I believe that we can expect very different conditions in the coming year from those that we had in the first year of the European war. Electrical contractors and electrical interests in general will not only see direct benefits from the celebration of Electrical Prosperity Week; they will realize also, in my judgment, substantial results from the improved conditions of business in all other industries. As an example, my business has been particularly good for the last three months, and the close of the year finds the situation promising for the work of the immediate future. Reports of the same state of affairs come from all parts of the country and are very encouraging and confident.

In the last few years electrical contractors have abandoned the old-time attitude of waiting in their offices for business to come to them. They have learned that the way to get business is to look for it in the places where it is to be found, and to keep steadily at the work of building up new customers. Contractors have been taught by experience that in order to get their fair share of the business available in the community they must practice salesmanship. Their contact with the Electrical Prosperity Week movement has helped to teach them the necessity of adopting merchandising methods.

CO-OPERATION RESULTING FROM PROSPERITY WEEK

Undoubtedly the enthusiasm developed during Electrical Prosperity Week gave a splendid impetus to the encouraging trade conditions which mean so much to electrical contractors. The co-operation of merchants was a great help to contractors. It meant, in effect, that the spirit of Electrical Week could be so extended as to maintain an effective interest in electrical purchases for the entire month of December.

Another good result which was observed in Washington is characteristic of the experiences reported by others in various sections of the country. That is the exhibition of hearty co-operation and good feeling between the central-station, the manufacturer, the jobber and the contractor. With this kind of co-operation in the common cause it has been proved to be so much easier to produce tangible results that there will be more pulling together in the future and much less conflict in matters involving the larger interests of all elements of the industry.

PROSPECTS FOR THE 1916 CONVENTION

Unless there is a material change in business conditions and prospects, the 1916 convention of the National Electrical Contractors' Association, which is to be held in New York, will be the best one in the history of the organization. It will give emphatic evidence of the prosperity which I expect will be indicated at the meeting of the executive committee to be held on Feb. 7 at Richmond, Va. But even without such official testimonies to the encouraging situation we have the glowing reports from all sections of the country to spread hope and faith for better things electrical.

Canadian Electrical Industries During a War Year

BY ALAN SULLIVAN
Secretary-Treasurer Canadian Electrical Association

THE electrical year of 1915 in Canada showed a very satisfactory development among the privately owned corporations. Its early months, shadowed by a depression which was the natural consequence of economic conditions that were only beginning to be understood, revealed a falling off in business and a general atmosphere of commercial uncertainty. This soon changed, however, to a feeling of confidence. It became apparent that excellent crops were assured, and the war demanded most of the products that Canada has for export.

The manufacture of munitions has occasioned a large demand for power. Railway returns now show a normal condition of traffic. Much money that was formerly spent abroad is now spent in the country, and our exports now surpass our imports.

Various localities reflect national conditions. The Quebec Railway, Light, Heat & Power Company had the best year in its history. The Montreal Light, Heat & Power Company states that the new business taken on in the six months preceding Oct. 31 was 15,000 hp. and 120,000 lamps of 16-cp. equivalent. The new installation of this company at Cedars Rapids, on the St. Lawrence River above the city, went into service in January. Its full output of 100,000 hp. is sold, and already another unit is demanded. This company has one customer, the Aluminum Company of America, using 60,000 hp. in Messina, N. Y.

The Shawinigan Water & Power Company is extending rapidly, and purchased recently the Dorchester Electric Company's assets, thereby providing another source of energy for the city of Quebec.

ONTARIO COMPANIES MEET COMPETITION

Further west—in the Province of Ontario—it is vastly to the credit of the privately owned companies that they have extended their activities successfully in the face of an anomalous system of competition. The Hydro-Electric Power Commission of the Ontario government, operating through various municipalities, apparently embarked on the program of putting the private interests out of business by supplying power at cost. Although relieved of all municipal and corporation taxes, government dues and right-of-way costs, and though securing as well its funds at the low interest paid on city and provincial debentures, the power commission's activities have resulted in a very healthy expansion of its competitors' business.

RATE REDUCTIONS IN TORONTO

The municipality of Toronto, distributing power in competition with the Toronto Electric Light Company, reduced its rate in January last by a cut of between 20 per cent and 25 per cent in its lighting charges and between 7½ per cent and 10 per cent in its power charges. As the privately owned company was already handicapped in the competition by the payment of large taxes on its plant, this cut looked serious and appeared to be likely to result in loss of business to the electric light company. However, in March the Toronto Electric Light Company brought out a different system of

rates, offering inducements to its customers to increase their load-factor and thereby secure an earned reduction. The company did this instead of following the rate principle adopted by the Hydro-Electric Power Commission, which was a general reduction regardless of whether or not it was earned.

The result of the year's operation has been that the Toronto Electric Light Company has increased its load and slightly increased its number of customers, although owing to the fierce competition more energy has been expended in retaining its business than in getting new business. This has been accomplished successfully, and the output in kilowatt-hours for 1915 will be approximately the same as, or slightly higher than, they were in 1914.

In November the Toronto Electric Light Company, realizing that outside of municipal power its competitor's most profitable business consisted in commercial lighting, introduced a flat rate for this class of business, and in the short time this has been in operation it has proved highly successful in obtaining business from the competitor.

This company is in an especially favorable position to adopt a flat rate, though it might appear generally to be a retrograde step. It obtains its own power from the hydraulic plant at Niagara Falls, owned by its affiliated company, which also owns transmission facilities from Niagara Falls having a reserve of at least 100 per cent of the local demand. It has itself a complete distribution system in the streets of the city, requiring little extra capital investment to take on all the commercial business along the principal thoroughfares. Under these circumstances and owing to the municipal competition, the company felt that it was justified in giving more kilowatt-hours to its customers at a rate sufficient to allow an adequate return for the addition to its peak demand for power.

Load from War Orders

The power companies on the Canadian side of Niagara Falls are running at the full capacity of their installed machinery. The combined load is probably 50 per cent higher than last year.

A great deal of this load appears to be in use for manufacture of war munitions of various kinds and may be more or less temporary, but it is difficult to believe that organizations once created will be abandoned when the war is over, as owing to the increased demand for manufactured articles of all sorts from Canada and the United States, and the many new chemical and other processes of general kinds being established to replace materials formerly imported from Europe, the stability of the power demand cannot be questioned.

The Ontario Power Company has been forced to buy energy in addition to its own output of 190,000 kva. The Toronto Power Company has sold its entire capacity of 110,000 kva. The Canadian Niagara Power Company is installing three more generators of 12,500 kva. each.

Hamilton reports the low-water mark of business as occurring early in the year. It is now normal, with a tendency to increase. This is due partly to the munition industry. The Algoma Steel Corporation at Sault Ste. Marie has 15,000 kva. hydroelectric, 10,000 kva. gas-driven, and 2000 kva. steam turbine-generated energy. At Michipicoten, on the north shore of Lake Superior, the corporation has generated hydraulically 3000 kva. for use in its iron mines.

North—in New Ontario—where the Cobalt blooms, the Northern Ontario Light & Power Company has harnessed waterfalls and transmits about 10,000 kva. for mining purposes.

The Ottawa Electric Company has successfully met the Hydro-Electric Commission competition in the shape of a rate reduction order sent from Toronto to the municipality of Ottawa.

Winnipeg and Vancouver business has been somnolent, although a renewal of mining on a large scale is observable in British Columbia. The West does not manufacture in the broad sense, but grows food and lumber. In the matter of economics it is therefore soundly established. Its wheat crop for 1915 is worth $300,000,000.

Great Development Ahead

When Canada has recovered from the shock of war and the immense sacrifices involved, the country will enter on a new era of progress. We are beginning to see in clearer proportion the tremendous development that lies ahead. In this development the electric industry will play a notable part.

"Probably the largest factor which points to continued prosperity is the general feeling of confidence that is manifested everywhere."—A. W. Berresford.

Exceptional Conditions Affect Development of Electrical Manufacturing

By A. W. Berresford
President Electrical Manufacturers' Club

As we consider the conditions of 1915 and the prospects for 1916 at the turn of the year many complex factors are found. No one can doubt the marked revival in business during the last six months of 1915; and, what is of equal importance, there can be no doubt that while this may have been initiated by war orders, it is to-day on a foundation of far more substantial character. As to the future, probably the largest factor which points to continued prosperity is the general feeling of confidence that is manifested everywhere. It is my belief that at least a season of generally good business may confidently be looked forward to.

This belief is based on several facts which are fundamental: That the railways in general are showing marked improvement in traffic and earnings, and are purchasing materials again; that the steel industry is operating under pressure with advance orders booked which are far in excess of productive capacity; that the

basic pig-iron market has broadened until it is in a generally active and healthful condition, and that while possibly there will be some decrease in the orders for munitions placed in this country by foreign buyers, still a number must be placed that will be sufficient to insure an activity that, coupled with the preparations that our own government must make, will result in considerable production in these lines. The continuation of orders for munitions means that the allied lines which manufacture the machinery used in the production of these materials will be active and that labor in general should be well employed. The last-named condition must result in increased business in the lines of staple consumption, and already this increase has begun to make itself distinctly felt.

LABOR AND WAGES AT CONCLUSION OF EUROPEAN WAR

There is another side of the picture which should not be overlooked. This includes the labor situation; the fact that up to the present time our efforts to develop and retain foreign trade have been more in the direction of discussion than of action, and the impossibility of predicting with reasonable accuracy what the European labor conditions will be at the close of the war. My opinion on the influence of these factors is summed up as follows:

The labor situation in this country appears to be in a fair way to be handled fairly and successfully. The extreme conditions under which contractors for munitions were obliged to operate if they accepted orders naturally tended to upset the normal balance and to create an undesirable situation in that part of the industry which was not directly affected by the orders from the belligerents.

Analysis of these conditions by the employer caused him to realize the danger, with the result that arrangements were made to present to employees the exceptional conditions which made the contemplated wage schedules possible, and at the same time to compensate them properly and in such a manner that they will comprehend the reason for reductions when business shall return to a normal basis. Unquestionably there will be an increase in labor agitation and some situations will arise which will be difficult to handle. However, I can see no reason why any radical change in the relations between labor and capital should be necessary, and I do not myself believe that such a change is at all likely to occur.

THE OUTLOOK FOR FOREIGN TRADE

In the foreign-trade outlook there is promise in the third meeting of the National Foreign Trade Council, which is to be held in the latter part of January. It is my understanding that the purpose of this convention is to reduce theory to practice and to try to obtain action wherever the necessary and proper steps can be clearly indicated. The council will be able to give from actual experience adequate reasons why some of our past and present policies serve to prevent the upbuilding of foreign trade.

With respect to the conditions in Europe at the close of the war every man has his own theory. The fact that a great diversity in opinion exists is encouraging. It leads to a hope that the results may not be so strongly adverse as some of the analyses indicate. My own feeling at present is that an attempt of considerable proportions will be made to "dump" articles of foreign manufacture in this country; but if the discussion which is now taking place continues and becomes even more active, as would seem to be probable, those who are in authority should be sufficiently advised and aware of the danger to make comprehensive provisions to anticipate and offset it.

"The Electrical Prosperity Week movement has yielded results of a public-policy character which are substantial and of lasting value."—JAMES M. WAKEMAN.

Good Public Relations Promoted by Electrical Prosperity Week

BY JAMES M. WAKEMAN

General Manager Society for Electrical Development, Inc.

IT is highly encouraging to the supporters of the Society for Electrical Development to find that the Electrical Prosperity Week movement has yielded results of a public-policy character which are substantial and of lasting value. Started as a co-operative venture to interest and weld together the various branches of the industry, this movement grew into a great trade and sales campaign; but underlying it was a golden opportunity to improve public relations.

The full importance of this opportunity was scarcely realized at first even by those who were most active in the work. But now that the reports of successful experiences are reaching us from every direction and we have time to appraise the advantages obtained by the unprecedented co-operative effort we find evidences of a splendid harvest in improved public feeling toward the central-station industry. The amazing sales returns alone make the week rank as one of the most notable achievements of the year, but when we include also the more friendly feeling which was developed I am confident that a powerful stimulus has been given to the good-will assets of the entire industry.

The fact that nothing about the Electrical Prosperity Week movement could possibly encourage friction was in our favor. Its foundation of "prosperity" eliminated every chance for antagonism. Naturally it made its strongest direct appeal to the industry which was responsible for it. But it went so much farther in its logical, reasonable appeal to merchants, to public officials and to all civic organizations that it enlisted easily their full and cordial support. With such a spirit in the beginning all who took part in the movement were placed on an equality of interest and purpose. They joined hands whole-heartedly to work toward a common end whose benefits were clear to all. The city officials had the same large idea of benefiting local business as the central-station man.

The desire to make a creditable showing, redounding to the advantage of each community and its home industries, is one on which all classes can unite. And I believe that the ultimate effects of this season of co-operation will be far-reaching and exceedingly helpful to the companies in settling public-policy problems.

"We, who are informed, have faith in our utilities and in the high ideals and integrity of the men responsible for them."
—Ell C. Bennett.

Shaping Public Opinion Through Local Electrical Influence

By Ell C. Bennett

Mercury of the Jovian Order

LET us acknowledge that the success of public utilities is not only one of the most important factors in the development of any community, because good service and low rates mean comfort and convenience in the home and incentive for increase in industrial activity, but that it is also essential to prosperity in all other branches of the electrical field.

When the utility is hampered and harassed by antagonism from its public and restrictive, injurious legislation, which is but a political reflection of the spirit of the people, the community suffers and the business of the entire industry decreases because of enforced retrenchment policies in the utility.

We, who are informed, have faith in our utilities and in the high ideals and integrity of the men responsible for them. If the public thinks otherwise, it must be that the individuals and organizations within our industry have not prosecuted consistently and thoroughly enough the task of properly informing those without our field.

How can we of the industry get the facts before the public and form public opinion?

Let us consider any community and the individuals in the electrical industry who are occupying positions of importance there. With few exceptions the latter are either taking no interest in civic matters outside their own immediate business or they have elected to do their public work in more or less minor capacities under the banner of the "chamber of commerce," "business men's league," or whatever name their pet organization may carry. In general, however, it is not called "Jovian" or "electrical," and therein one great possibility for good is being overlooked.

Who can successfully combat the logic in the plan that our electrical men of influence and power shall devote the time they may have for civic work as leaders in securing for the local electrical organization the reputation of being the livest of all local business organizations, striving always not alone for those things which benefit only the electrical industry but for any cause that means the upbuilding of its community?

If this plan is consistently and intelligently followed, not only the local electrical league, but the individuals connected with it, the utilities and the entire local electrical industry they represent, will be raised to a high plane of confidence and respect.

It is up to the big men in our industry to utilize the organization that has been created within it; their passive consent to its continuance and the interest in it of their subordinates is not sufficient.

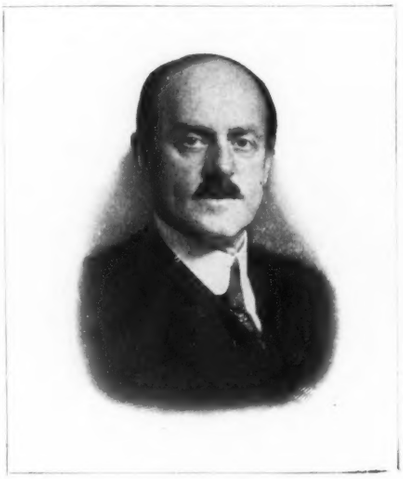
There are in existence to-day some seventy-five local electrical leagues, and that number will be increased through the efforts of the Jovian Order to not less than 100 within six months. These leagues have in the past with very few exceptions not even approached a realization of the power for good latent within them, and that fact may be directly traced to two causes—first, lack of the active interest of the big men; second, failure to appreciate their opportunity and responsibility as city-building organizations.

The second fault will be remedied by instructive material supplied by the Jovian Order, but the first is up to men of the industry in positions of importance.

If you are a utility man and would welcome a force that would cement in closest relations of confidence, friendship and harmony your company and its public;

If you are engaged in another branch of the industry which, no matter what it is, is dependent to an important degree on the welfare of the utility—

Build up your local league and do your "city-fathering" through an organization where not only your community but your business will secure the attendant benefits.



"Co-operative standardization of products, historical publicity of business procedures, of average commodity prices, and possibly, within each given industry, historical publicity of average commodity costs, may be discerned in the vista of the new year."—Robert K. Sheppard.

Opportunities Ahead for Electrical Supply Manufacturers

By Robert K. Sheppard

President Associated Manufacturers of Electrical Supplies

THE opening door of 1916 discloses tremendous opportunities for American industries. The sense of our American people is triumphing over the prejudice of individualisms. Unrestrained competition has sorely strained and withered our business sinews for the last time. Governmentally our

country has proclaimed the era in which industry may be encouraged and upbuilt by our public commissions, and the laws of our land may be applied righteously if our business men will contribute frankly and fully to the solution of the problems of such regulative authorities as our Federal Trade Commission. Co-operative standardization of products, historical publicity of business procedures, of average commodity prices, and possibly, within each given industry, historical publicity of average commodity costs, may be discerned in the vista which the new year is offering.

The electrical fraternity, already a well-developed child in the family of modern applied science, now may exercise its strength, its inventive genius, its enthusiasms, even more constructively than in the past fifty years of its wonderful growth. The foundations of individual successes are firmly laid, and the achievements of the past have bequeathed to the electrical industry wealth, position, responsibility.

The manufacturers of electrical supplies already are undertaking with thoughtful and accustomed thoroughness their part in the tasks incident to the rapid enlargement of the influence of our country on the commercial future of the world. They are bold and yet discreet; they are honorably cautious, yet abundantly enthusiastic without recklessness.

"The return to normal conditions in the business world will be in direct ratio to our readjustment and recovery from our over-stimulated pace of the last decade."—E. R. HARDING.

Demand for Electrical Machinery Overtaking Capacity to Produce

BY E. R. HARDING

President Electric Power Club

THE demand for electrical machinery during the first half of 1915 indicated an endeavor to return to normal conditions. Orders, however, were spasmodic, and the inactive periods were difficult to analyze. At the beginning of the last half of 1915 a healthy and gradually increasing demand for electrical machinery began. It has continued to date, with the closing months the best of the year.

Periods of depression in the commercial world are traceable to the same natural laws that govern the physical world. You cannot over-stimulate the physical body in brain, nerve or muscle without having a period of reaction set in for rehabilitation and adjustment. In the last two decades the business world has gone at a terrific gait and has been unnaturally over-stimulated. The result was that we found our factories with a capacity greater than necessary, business houses inefficiently organized and with extravagant methods, and the investment world, especially in the railroad field, quite generally carrying doubtful investments in the form of over-capitalized securities.

All of these conditions must be adjusted: Demand must overtake capacity; organized efficiency must take the place of "first-aid" methods; inflated securities, carrying small intrinsic value, must be liquidated. The return to normal conditions in the business world will be in direct ratio to our readjustment and recovery from our over-stimulated pace of the last two decades. The question for the future is, At what place have we arrived in the process of rehabilitation?

"The Illuminating Engineering Society expects a year of greater activity than ever before in all the fields covered by it."—DR. CHARLES P. STEINMETZ.

Plans of the Illuminating Engineering Society for 1916

BY DR. CHARLES P. STEINMETZ

President Illuminating Engineering Society

THE Illuminating Engineering Society in 1916 celebrates the decennial of its existence. This will be an occasion to review and record what has been accomplished in the art and to initiate plans for future advance, and the society therefore expects a year of greater activity than ever before in all the fields covered by it. The illuminating engineer has to deal not only with engineering, like other engineers—that is, with applied physics—but his work includes the problems and the knowledge of physiology and of psychology, is of importance to the ophthalmologist and to the sanitarian, and is closely related to that of the architect, the decorator and the constructor. It is one of the broadest fields of human activity, and it is hoped that the coming year will enable the society to produce a compendium of the entire field of the science and art of illumination and make it available to the practicing engineer or architect as well as to the ophthalmologist, the college professor and the student.

In celebration of the decennial of the society, a midwinter convention will be held in February, with numerous technical papers, and the feature of this convention will be the acceptance of honorary membership in the society by the man who has made modern illuminating engineering possible, Thomas A. Edison.

Lighting Industry Earned $360,000,000 in 1915

The Kilowatt-hour Output Estimated at 18,400,000,000, a Gain of 1,600,000,000 Kw.-hr. Over 1914—Earnings Increased by $23,500,000—October Returns Reflect Improved Industrial Conditions

The earnings and output of the light and power companies reporting to the ELECTRICAL WORLD for October show an increase of 9.8 per cent and 14.6 per cent respectively in comparison with the earnings and output for the preceding October. For the eighteen months that these data have been compiled and published this increase in earnings is the largest on record, and the percentage increase in output is the largest with the exception of that for September, 1915. However, owing to the size of the October output in comparison with that for September, the actual increase in the October output is the largest reported by about 10,000,000 kw.-hr.

The Central States gave the largest percentage increase in income during October, with the New England

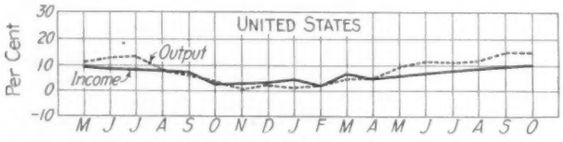


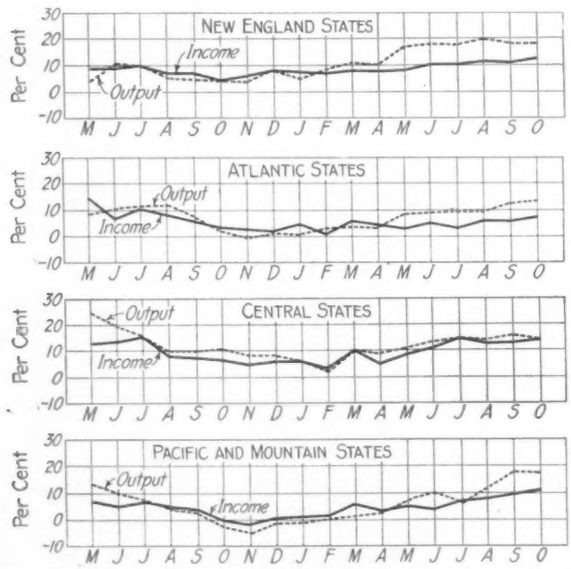
FIG. 1—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

States, the Pacific and Mountain States and the Atlantic States following in order. In output, however, the New England States stand first in percentage increase, with the Pacific and Mountain States next, followed by the Central States slightly in lead of the Atlantic States. In both the New England States and the Central States the percentage increases in output and income have varied but little in the five months June, July, August, September and October. In the other two sections, however, these percentages of increase still grow.

PROSPERITY IN OTHER LINES REFLECTED

These increases are strictly in line with the glowing reports of prosperity that come from every quarter of the country. Bumper crops, renewed activity in the building trade and copper mining, the enormous operations in zinc mining, the increasing output of automobile factories, the feverish activity of munition factories, the swamped condition of the iron and steel trade and of the factories of manufacturers of almost all kinds of machinery are all reflected in the operations of the light and power utilities. Manufacturers of electric motors report that never in the history of their trade have they had so much business. So great has been the demand for motors that it is practically impossible to buy a second-hand motor, while to purchase new motors means a wait of weeks for delivery. The demand for incandescent lamps, also, is the greatest it ever has been. The increased demand on the central stations for service has necessitated extensions by large numbers. Wire and cable manufacturers report an excellent and increasing business for extension work even in the face of the present high prices.

The returns show that the best business is being enjoyed by the utilities that operate in cities having a population of over 25,000 inhabitants. In cities having a smaller population the general results are not so good, and quite frequently they are very poor.



FIGS. 2 TO 5—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

INCREASES FOR FIRST TEN MONTHS OF 1915

During the first ten months of 1915 the increase in income for the entire industry was 6.1 per cent, and for output was 8.5 per cent, while for the year ended October, 1915, the percentage increases were 5.7 per cent in income and 7.3 per cent in output. A further division of these returns into sections shows the following average percentage increases for the first ten months of 1915: New England—income 8.4 per cent, output 13.3 per cent; Atlantic States—income 4.4 per cent, output 7.0 per cent; Central States—income 9.5 per cent, output 10.6 per cent; Pacific and Mountain States—income 4.8 per cent, output 7.0 per cent. For the year ended October, 1915, the figures are as follows: New England—income 8.0 per cent, output 12.3 per cent; Atlantic States—income 4.0 per cent, output 5.7 per cent; Central States—income 8.9 per cent, output 10.0 per cent; Pacific and Mountain States—income 3.9 per cent, output 5.2 per cent.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
1914							
Nov..	65	$19,777,650	$19,260,451	2.7	$986,456,324	$978,934,946	0.8
Dec..	65	20,978,430	20,281,812	3.3	1,074,083,543	1,043,457,795	3.0
1915		1915	1914		1915	1914	
Jan..	65	21,582,547	20,697,423	4.1	980,085,036	966,200,323	1.4
Feb..	63	19,395,518	19,023,107	2.0	853,817,221	835,288,039	2.2
Mar..	64	18,654,443	17,529,054	6.4	939,117,179	896,903,968	4.8
April.	65	18,406,412	17,675,784	4.2	900,536,022	859,235,144	4.8
May..	65	17,644,205	16,764,546	5.3	920,895,324	842,386,583	9.3
June..	65	17,603,614	16,476,255	6.9	925,067,308	836,292,076	10.6
July..	64	18,488,793	17,200,827	7.5	971,699,054	880,768,487	10.4
Aug..	64	17,342,796	16,024,893	8.2	951,752,053	853,381,696	11.3
Sept..	63	18,242,841	16,806,282	8.5	987,526,147	859,412,745	15.0
Oct..	63	19,494,911	17,757,263	9.8	1,062,152,014	927,578,152	14.6

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States 1914	New England States 1913	Per Cent Increase	Percentage of Industry Represented	Atlantic States 1914	Atlantic States 1913	Per Cent Increase	Percentage of Industry Represented	Central States (Illinois Excluded) 1914	Central States (Illinois Excluded) 1913	Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States 1914	Pacific and Mountain States 1913	Per Cent Increase
INCOME	Nov	67	$2,229,742	$2,115,957	5.6	69	$8,373,772	$8,157,966	2.7	57	$5,408,672	$5,158,981	4.8	88	$3,503,499	$3,574,086	2.0*
	Dec	67	2,385,711	2,218,387	7.5	69	8,765,275	8,594,773	2.2	57	5,992,542	5,654,740	5.9	88	3,834,902	3,813,912	0.3
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan	67	2,423,795	2,271,881	6.8	69	9,075,335	8,695,593	4.4	57	5,827,997	5,525,579	5.4	88	3,960,608	3,917,371	1.0
	Feb	67	2,246,794	2,134,341	5.4	69	8,037,878	7,968,625	0.9	55	5,296,786	5,148,439	3.0	85	3,576,432	3,534,864	1.2
	March	67	2,146,032	1,999,326	7.5	69	7,777,126	7,419,808	5.2	55	4,885,384	4,465,728	9.5	88	3,605,893	3,412,842	5.8
	April	67	2,109,767	1,976,473	6.8	69	7,510,810	7,241,164	3.9	57	5,003,673	4,773,949	4.8	88	3,475,740	3,366,830	3.2
	May	67	2,035,680	1,887,606	7.9	69	7,100,334	6,912,581	2.6	57	4,946,907	4,577,818	8.1	88	3,383,749	3,233,989	4.8
	June	67	2,063,423	1,874,575	10.2	69	6,945,986	6,628,523	4.8	57	4,993,410	4,492,411	11.2	88	3,409,738	3,281,696	3.9
	July	66	2,020,513	1,835,968	10.2	68	6,710,217	6,519,442	2.9	56	4,801,699	4,211,641	13.9	88	3,539,168	3,317,713	6.8
	August	63	2,057,635	1,855,140	11.0	68	6,853,118	6,511,307	5.3	56	4,749,082	4,231,322	12.2	88	3,545,454	3,288,729	7.8
	September	64	2,130,795	1,927,600	10.5	68	7,288,842	6,904,245	5.5	55	5,021,511	4,454,140	12.9	87	3,655,002	3,378,746	8.2
	October	63	2,284,530	2,038,557	12.2	68	7,990,931	7,451,022	7.2	54	5,400,576	4,762,559	13.5	87	3,748,922	3,429,867	10.5
KW.-HR. OUTPUT	Nov	67	69,480,163	66,988,456	3.8	69	361,364,405	364,155,759	0.7*	57	290,681,750	269,220,528	8.0	88	255,651,947	269,467,354	5.1*
	Dec	67	78,510,793	71,990,132	7.8	69	401,623,514	396,251,867	1.2	57	315,027,232	291,511,670	8.0	88	278,922,004	283,704,076	1.6*
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan	67	72,550,608	69,317,803	4.7	69	374,972,536	373,336,906	0.7	57	272,623,760	258,572,903	5.5	88	252,531,483	256,198,272	1.4*
	Feb	67	66,600,132	61,515,979	8.3	69	312,443,505	305,307,260	2.4	55	238,938,034	232,520,476	2.7	85	229,865,568	229,185,967	0.3
	March	67	72,121,319	65,343,335	10.5	69	346,341,496	335,506,429	3.3	55	257,136,231	235,656,647	9.2	88	255,529,704	253,423,951	1.0
	April	67	68,475,232	62,442,110	9.7	69	320,142,323	311,476,008	3.0	57	257,967,434	237,673,326	8.5	88	246,287,781	239,661,364	2.8
	May	67	68,823,914	61,060,621	12.9	69	326,191,569	301,440,779	8.1	57	262,885,043	236,154,464	11.2	88	254,586,394	236,082,868	7.8
	June	67	71,566,127	60,972 379	17.4	69	318,245,370	293,751,083	8.5	57	265,930,311	234,286,440	13.2	88	261,083,835	237,843,021	9.8
	July	66	71,025,184	60,755,381	17.0	68	320,371,761	293,909,832	9.0	56	264,498,989	232,541,585	13.9	88	274,488,334	258,475,004	6.3
	August	63	71,954,506	60,870,433	18.5	68	329,947,721	302,960,234	8.9	56	272,508,518	240,423,753	13.4	88	276,631,551	248,463,980	11.3
	September	64	74,120,515	63,378,193	17.0	68	358,765,971	319,549,780	12.3	55	271,727,863	235,386,720	15.3	87	278,933,924	237,633,240	17.5
	October	63	81,582,835	69,344,229	18.0	68	398,892,440	352,296,856	13.2	54	284,521,946	250,695,296	13.4	87	291,301,459	249,587,423	16.8

*Decrease.

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED ACCORDING TO SIZE

	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.
INCOME:									
Group 1	2.0	8.0	3.8	4.8	6.5	5.3	7.2	7.3	8.6
Group 2	3.7	6.9	5.0	6.2	2.8	8.8	9.1	10.0	11.8
Group 3	2.5	5.2	5.5	5.8	10.1	9.7	14.5	15.4	16.7
Group 4	6.8	5.0	3.9	7.1	6.9	8.2	8.0	9.0	9.0
Group 5	0.9	1.6*	1.9	5.5	4.7	8.5	7.5	11.9	7.5
OUTPUT:									
Group 1	2.8	5.7	5.4	7.2	10.1	11.1	9.7	12.2	10.2
Group 2	5.7	7.9	11.2	13.1	9.1	18.1	19.0	18.9	22.4
Group 3	3.9*	3.6*	1.2*	6.1	11.2	4.5	13.0	24.0	28.1
Group 4	5.5	3.2	3.0	29.1	6.0	12.5	10.9	11.3	14.0
Group 5	15.0	7.0	5.9	15.5	14.8	20.5	12.7	19.3	4.3

*Decrease.

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.
INCOME:									
Group 1	5.7	6.6	6.3	9.4	11.6	11.2	11.0	10.6	12.7
Group 2	4.1	9.0	4.04	7.5	7.0	7.0	9.6	10.3	12.6
Group 3	0.7	7.8	20.6	8.9	21.8	10.2	16.5	14.7	14.0
Group 4	9.4	6.5	8.4	7.1	11.9	6.6	9.2	10.0	8.9
Group 5	1.9	14.7*	0.4*	1.0*	2.8	16.0	21.2	5.8	8.4
OUTPUT:									
Group 1	11.1	12 0	12.7	16.0	19.0	17.2	17.2	19.2	20.8
Group 2	6.4	12.3	12.3	19.9	20.8	26.0	26.0	21.7	18.3
Group 3	3.6*	0.3*	3.2	7.0	17.9	13.5	12.3	14.4	1.9
Group 4	9.4	12.5	12.1	6.3	17.1	7.8	13.6	9.0	20.4
Group 5	6.1	29.8*	25.5*	13.5*	1.0	11.0	15.1	8.5	1.8

*Decrease.

1915 ESTIMATES

The curves shown in Fig. 6 present the totals for the monthly income and output of the entire industry with the November and December figures estimated on an increase over the 1914 figures which are at hand. By adding these monthly totals it will be found that the earnings of the light and power industry for 1915 are roughly $360,000,000, and the output roughly 18,400,000,000 kw.-hr. These figures represent a gain of approximately $23,500,000 for the year in gross income, and an increase in output of approximately 1,600,000,000 kw.-hr. The percentage increases for the year are roughly 7.0 per cent in income and 9.7 per cent in output.

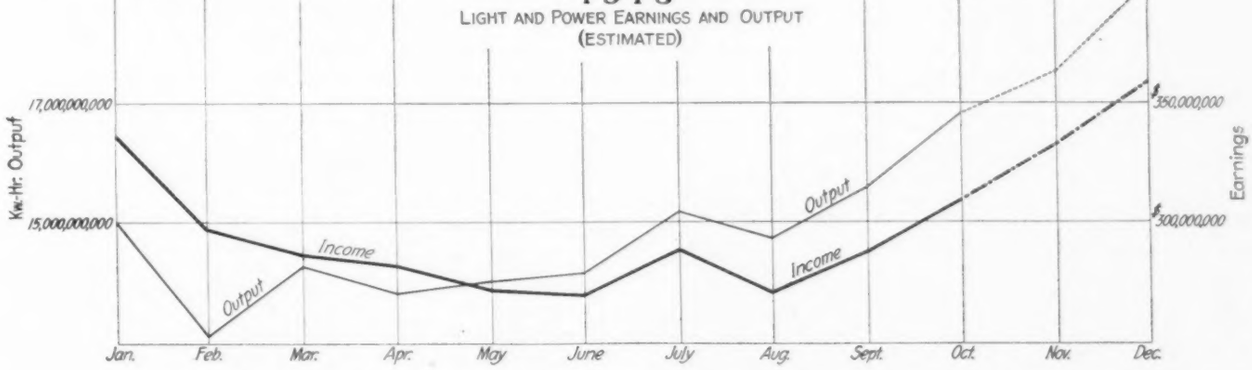


FIG. 6—TOTAL ESTIMATED MONTHLY EARNINGS AND OUTPUT FOR CENTRAL STATIONS FOR THE YEAR 1915

There are included in these figures only the earnings and output from light and power. The output is that which is paid for, and does not include any energy used

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED ACCORDING TO SIZE

	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.
INCOME:									
Group 1	1.3	4.7	1.6	2.0	3.8	1.4	4.0	4.4	6.2
Group 2	4.2	7.1	5.6	8.2	8.0	9.7	11.6	11.0	12.8
Group 3	3.6	3.8	4.1	1.6	7.5	7.5	8.5	8.9	11.0
Group 4	10.1	6.8	2.9	6.2	3.9	7.0	8.4	10.0	10.0
Group 5	†	†	15.2	19.6	14.8	†	2.0*	14.3	10.9
OUTPUT:									
Group 1	3.0	6.1	4.8	9.0	8.2	8.0	9.0	11.6	12.1
Group 2	7.0	9.7	7.6	7.1	11.0	17.0	15.0	16.3	16.3
Group 3	2.7*	8.5*	4.1*	3.2	7.2	7.5	6.4	10.4	15.8
Group 4	6.3	10.2	1.9	22.5	7.1	13.8	13.2	12.5	14.8
Group 5	†	†	57.2	71.5	61.8	†	11.4	13.8	2.8*

*Decrease. †Results omitted owing to insufficient returns.

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED ACCORDING TO SIZE

	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.
INCOME:									
Group 1	3.5	10.1	7.3	9.8	11.4	11.8	12.2	12.4	12.7
Group 2	1.4	5.9	3.5	3.0	5.6	7.0	7.5	8.6	9.8
Group 3	6.2	11.3	10.4	15.5	19.6	16.4	21.0	22.0	22.7
Group 4	6.0	8.3	6.0	6.7	12.4	13.0	16.9	17.9	18.0
Group 5	2.8	7.7	7.6	19.9	5.0	1.2	20.2	13.5	11.0
OUTPUT:									
Group 1	4.7	7.7	6.8	8.4	10.8	11.8	12.2	15.2	9.1
Group 2	1.2	8.0	12.5	9.7	13.5	11.1	9.8	9.0	17.0
Group 3	6.2	14.7	13.1	27.0	26.1	28.9	31.0	29.3	34.2
Group 4	10.0	12.8	7.9	10.0	15.7	18.2	26.1	29.0	29.5
Group 5	18.3	13.5	39.7	28.8	20.4	24.9	25.1	48.0	28.0

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.
INCOME:									
Group 1	0.4	8.1	4.0	3.1	9.0	5.1	7.0	13.9	7.5
Group 2	8.0	7.5	9.4	12.7	11.1	13.0	11.1	11.5	14.3
Group 3	2.6*	1.0*	0.3*	3.4	3.6	7.9	17.1	19.7	21.4
Group 4	0.6	2.6*	3.8*	8.7	1.6*	7.8	0.2	0.3	0.2
Group 5	2.0*	3.5*	2.7*	2.4*	3.3	4.5	1.7*	15.0	1.9
OUTPUT:									
Group 1	0.5*	2.5	4.5	2.3	10.8	6.2	6.3	8.4	7.1
Group 2	13.5	3.0	11.6	19.0	14.9	27.5	39.3	40.3	41.3
Group 3	11.5*	4.0*	3.5*	3.8	12.4	8.4*	18.5	49.2	52.4
Group 4	0.6*	9.5*	4.7*	87.0	4.5*	11.8	0.2	4.1	1.4
Group 5	9.9	18.0	9.6	18.5	3.6	10.9	8.0	21.0	3.1

*Decrease.

by the utilities for which no income is derived. The income represents only the revenue derived from the sale of energy, and does not include that proportion of the expenses paid by other branches of the utility for energy used. Furthermore, other items of central-station income, such as interest on bonds held in the treasury, gross merchandising revenues, service-connection charges, etc., which tend to swell the total by many millions of dollars, are not included in the above figures.

The other curves show graphically the percentage increases in Tables I and II. The remaining tables give the percentage increases for companies grouped according to size. Group 1 is based on returns from companies operating in cities having a population of over 100,000 inhabitants. Group 2 includes cities having between 50,000 and 100,000 inhabitants; group 3, between 25,000 and 50,000; group 4, between 10,000 and 25,000, and group 5, between 5,000 and 10,000.

Hydroelectric Development and Food Supply

The paralysis imposed seven years ago upon the development of water-powers in the United States, particularly in the West, through the interpretation of federal laws and through regulations of federal departments, is still in effect, but while development has thus been hindered in the United States there has been in marked contrast great hydroelectric development in Europe, where over 1,200,000 water hp. has been utilized for the extraction of nitrogen from the atmosphere. Not a single horsepower is being used in the United States for that purpose. This statement was made by Henry J. Pierce of Seattle, noted hydroelectric engineer, in an address which he delivered before an interested audience at the Commercial Club in Boise, Idaho, recently.

Mr. Pierce estimated that there are 10,000,000 acres of arid lands in the West that can be irrigated through the pumping of water to them when the electricity is available, This land, he said, would support a population of 2,000,000 people. He said lands are being irrigated in twenty-seven States, and as far east as New Jersey and Florida. Two Western States, he told his audience, have nearly 5,000,000 acres of land under irrigation.

Some very interesting facts were given by Mr. Pierce in relation to the use of electricity by railroads. He said that it is estimated that 10,000 hp. is needed to operate 100 miles of single track, and therefore it would require 4,870,000 hp. to electrify all of the railroads of Idaho, Washington, Oregon, California, Montana, Wyoming, North Dakota, South Dakota, Utah, Arizona, Colorado and Nevada.

How Germany Gets Nitrogen from the Air

Mr. Pierce said he had visited Germany on a number of occasions and in his talks with prominent men there learned before the present European conflict broke out that war was inevitable. He said he did not believe it then, but he was informed that Germany at that time had brought its lands under cultivation so that 95 per cent of its foodstuffs could be raised at home, and had solved the problem of supplying the nitrogen necessary for explosives by extracting it from the air through means of electricity.

Speaking of the necessity of taking nitrogen from the air in this country, Mr. Pierce said: "The greatest reason for the development of our water-powers is the imperative necessity—and it is a national necessity—that sufficient fixed nitrogen should be produced within the boundaries of the United States to meet its requirements. Nitrogen is absolutely necessary to the existence of animal and plant life. Without fixed nitrogen the earth would soon become an uninhabited desert waste. While the atmosphere contains an exhaustless supply of nitrogen, yet 90 per cent of the plant life that lives in it does not absorb it, and the remaining 10 per cent absorbs but a small proportion of that which it requires.

"The world has been dependent for most of its supplies of fixed nitrogen upon the nitrate-of-soda beds of Chile. During 1913 the United States imported 625,000 tons of Chilean nitrate, valued at $21,000,000, upon which the Chilean export duty was 60 per cent. The United States thus paid to the Chilean government $12,600,000, which may be considered merely a part of the amount which the people of the United States pay for its policy of water-power stagnation. In other words, the people of this country would be quite as well off as they now are if they granted a subsidy or bonus of $12,600,000 per annum for the establishment of the water-power nitrogen industry in the United States."

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Load Dispatching by Wireless on Pacific Coast

How a Western Transmission Company Uses Wireless Telegraphy When Telephone Line Fails—Experiences That Demonstrate Its Value—A Suggested Use for Wireless Telephony

BY L. T. MERWIN

General Superintendent Northwestern Electric Company, Portland, Ore.

OPERATING engineers, particularly those in Western States where the isolated hydroelectric plant is often the source of energy, should find special interest in recent announcements of the success of transcontinental wireless telephony. Wireless telephony is destined to become an invaluable adjunct in station load dispatching, its application to this field being only a question of time. Complete wireless sending and receiving stations were installed one year ago by the writer at both the White Salmon River generating station and the Albina substation of the Northwestern Electric Company. The substation is in the city of Portland, Ore. Since that time the "air" has been a regular and successful means of communication whenever the metallic telephone system has been in trouble.

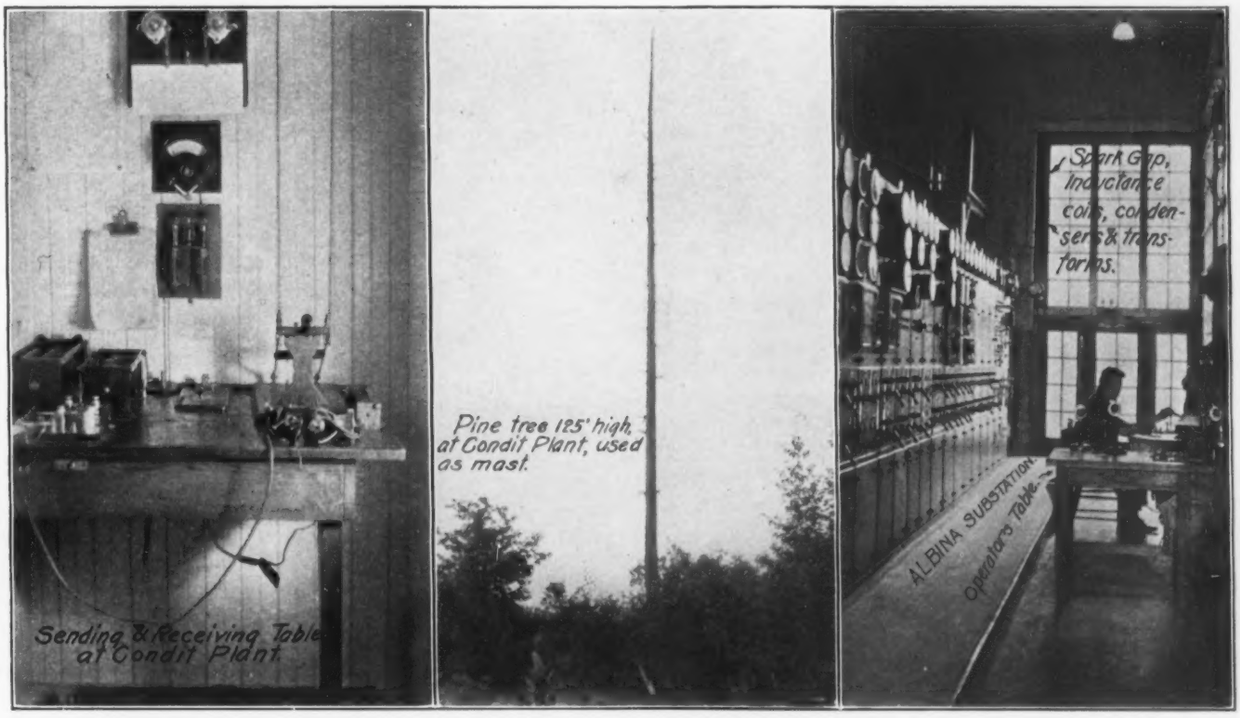
DIFFICULTIES IN COMMUNICATING BETWEEN ISOLATED STATIONS

The distance between these two stations is 65 miles, with the Cascade Range of mountains between. The transmission line which brings the energy into the city follows the north bank of the Columbia River gorge for some 50 miles—a rugged, rocky right-of-way necessitating unusually long spans and being subject during the summer to interruptions from road blasting and logging operations, and in the winter to severe sleet storms and high winds. Single cedar poles are used on spans up to 600 ft., and double-pole construction for those of greater length. The greatest span is some 1300 ft. long. The power conductors are of steel reinforced aluminum, 302,000 circ. mil in section. A telephone line of No. 9 iron B. W. G. is strung on the same supports some 7 ft. below the power conductors.

WIRELESS USED BETWEEN GENERATING STATION AND SUBSTATION

Many miles of the line are inaccessible except on foot, and telephone communication was often interrupted for twenty-four hours at a time. Telephone service, in addition to that by the company's line, is secured between the power house and the Albina substation over the long-distance toll lines of the Pacific States Telephone & Telegraph Company. These lines, however, follow the south bank of the Columbia River gorge and suffer from sleet even more severely than the company's private line. Consequently exceptionally severe weather often isolates the Condit plant absolutely from the Portland office, the main center of load distribution and control.

In 1913 it was suggested that wireless telegraphy would greatly lessen the trouble of keeping in touch with the generating station. A few experiments proved the plan to be entirely practicable, and construction on two wireless stations was commenced. Wooden masts 125 ft. high were erected at both stations with the inverted-


Sending & Receiving Table at Condit Plant.
Pine tree 125' high at Condit Plant, used as mast.
Spark Gap, inductance coils, condensers & transformers.
ALBINA SUBSTATION
Operator's Table

WIRELESS LOAD-DISPATCHING EQUIPMENT AT CONDIT AND ALBINA STATIONS, AND PINE-TREE AERIAL MAST

L type of antenna a little over 400 ft. long. The sending and receiving apparatus is of standard Marconi pattern of 4-kw. transformer rating, rotary non-synchronous spark-gap, crystal detector, and tuned to a wave length of 1700 meters.

The stations have been examined and licensed by the federal radio service and classed as limited commercial. Communication is carried on freely day and night, and it is seldom that static conditions interfere with the free interchange of messages. The wave-length insures the plants from interference by amateurs working on a short wave, and the navy stations of 1600 meters or 2000 meters are easily tuned out. The receiving at both plants is unusually good, and at night the operators have no difficulty in picking up Alaska stations on the north and San Diego on the south.

At the generating plant the receiving and sending equipment is installed in a small room on the switchboard gallery near the attendant's desk. At the Albina substation in Portland, where it is comparatively quiet owing to the absence of rotating machinery, the receiving apparatus is mounted directly on the operator's table, and the sending transformer, spark-gap, inductances and condenser are mounted on a platform above the switchboard.

No Difficulties in Operating Wireless System

The general routine of establishing communication is as follows: Clearance between the two stations on the telephone line is made regularly every half hour. Should the line be found inoperative, the attendants at each station go in "on the air" and establish communication by wireless. In case of serious power-line trouble the metallic telephone lines are nearly always found useless, and all orders are then sent and received by wireless. Should the trouble be of a nature to require constant switchboard attention, one of the operators off duty is called upon to "sit in" until the trouble is cleared.

Several times since the original installation of this system the cost of the outfits has been many times repaid. In fact, wireless has become an invaluable adjunct to our load-dispatching system, and it seems a wonder that power companies have so long failed to avail themselves of a so valuable and comparatively inexpensive a means of communication. This is one of the few regularly established installations of its kind; yet the entire cost at both stations did not exceed $600—an amount that might easily be lost many times over in an interruption which the wireless could prevent.

As to the question of operators, our experience has been that all the station attendants take great interest in becoming proficient in sending and receiving. In a month's time they are able to receive with fair accuracy, say at a rate of twelve to fifteen words per minute. Buzzer systems for practice are easily installed, and it needs only an adjustment of the receivers to permit all the practice the attendant desires in "listening in" on press dispatches out of San Francisco, ocean-going ships sending to and receiving from shore, and routine commercial work up and down the coast. In fact, what appeared to be the greatest difficulty—to get competent station attendants who were wireless operators as well—has completely solved itself in the natural aptitude and interest of the average station operator in this new line.

A Case Where Wireless Proved Its Value

Not long ago a message from the generating plant took a curiously roundabout path to reach the Portland station. Shortly after the telephone line between the two plants had been cleared the operator at the power house wished to talk with the Albina substation, but the telephone wires had gone out of commission during the interim. He "went in on the air," but could get no response. He then called the commercial station at North Head at the mouth of the Columbia River, some 100 miles farther on and west of Portland. There was still no response. While listening for a reply he recognized a familiar tone and found an Alaska station inquiring if he could be of any assistance by raising North Head. This latter operator succeeded and delivered the following message: "Condit plant wants North Head to telegraph by wire to Portland for Western Union operator to telephone to Albina substation that the power house wants him to sit in on the air." The message was delivered and communication established.

This brings up the one serious difficulty in the scheme—the lack of some positive means whereby one station may call another. The writer has experimented somewhat along that line, and the results have not been entirely satisfactory. It is merely a matter of amplification, and the De Forest audion bulb or the new tube of the General Electric Company will doubtless solve the problem. When this is done the last objection to wireless dispatching is overcome, and with wireless telephony now an established fact, the writer sees for it in the future a permanent place in the regular equipment of many transmission systems.

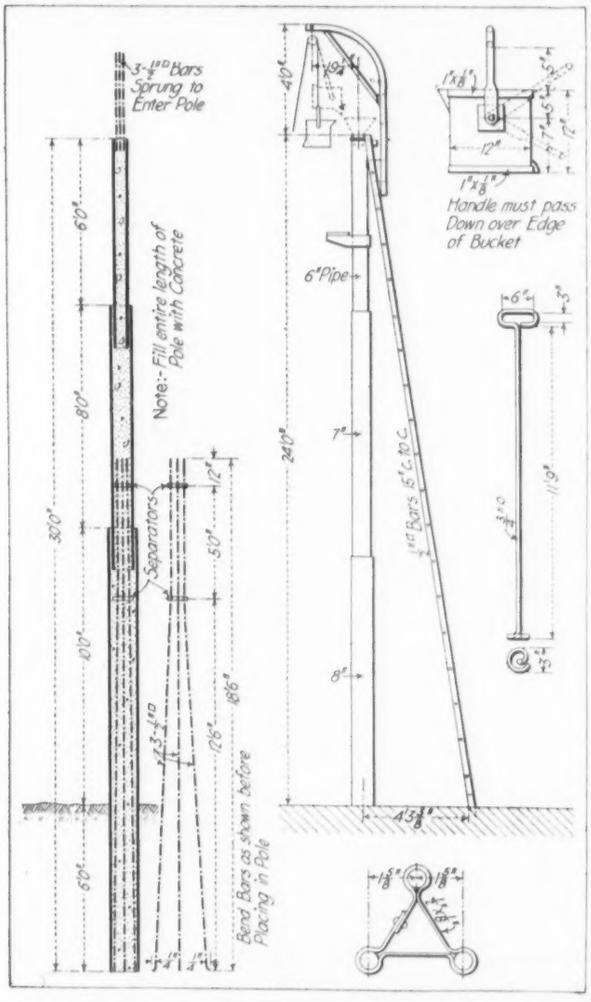
Comparing Load and Water-Rate Curves to Check Leaks

An incident which happened in a generating station in the East serves to illustrate how valuable comparisons of station-performance curves may be made. On the occasion referred to the operating engineer, having observed from the load and water-rate curves that considerable water was being pumped to the boilers during the no-load period, advised the water tenders that this condition should not exist. Thinking that the boilers should be fed only when carrying load, they subsequently supplied enough water to the boilers before banking to prevent the level becoming dangerously low during the time of no-load. This made a hump in the feed-water curve which was noticed by the operating engineer while making the usual comparison of load curves. Upon noticing that his former instructions had not been grasped by the water tenders, he ordered them to look for leaks between the boilers and engines. No leaks were found and, hoping to disguise their fruitless attempt at locating the trouble and still prevent the water level dropping too low during no load, they pumped the boilers full after the load dropped by continuing the usual rate of feed for about three-quarters of an hour. Since this period was represented by only a small section on the graphic chart, they hoped it would pass by unnoticed. When the operating engineer inspected the records closely to ascertain whether the leak had been located, he found that water was still being fed when no load was being carried. He investigated the plant himself and found a very obscure leak which accounted for the entire loss. It was caused by a defective valve in a large-diameter blow-off pipe that discharged into an inclosed drain which had concealed the escaping hot water. The fault was remedied and all water-gage tubes were marked, the water tenders being instructed to maintain that level at all times. After this experience, during which the attendants learned the relations existing between various station-performance curves and saw that defective operation could not be concealed, they took an interest in calling attention to future apparent inconsistencies in records. Had the records not been carefully compared, the leak might have escaped observation for a longer time and fuel have been wasted.

Concrete Filler for Reinforcing Hollow Steel Poles

How Trolley Poles Are Strengthened on Chicago Surface Lines at a Cost of $6 Each

AN interesting method is used on the Chicago Surface Lines to reinforce hollow-steel trolley poles that are weakened by rusting at the ground line. The poles are filled with concrete after placing three reinforcing rods of ½-in. twisted square steel in the core of the pole. These rods are held at the desired separation and position by spacers passed around rods before inserting. Concrete is then "poured" through a funnel at the top of the pole, as shown in the accompanying illustration.



FIGS. 1 AND 2—METHOD OF REINFORCING STEEL POLES WITH CONCRETE AND ARRANGEMENTS FOR CARRYING ON WORK

The work on the Chicago lines was carried on during the past summer by a gang of ten men, who filled on the average forty poles a day. Each 30-ft. pole 7 in. in diameter required about one and one-half bags of cement and 0.2 cu. yd. of concrete to fill the core; also 75 lb. of 0.5-in., 15-ft. reinforcing steel (six pieces) and six triangular spreaders were used for each pole. The estimated cost for material is approximately $3.50 and for labor $2.50, making a total cost for each pole amounting to $6.

As already mentioned, the Chicago Surface Lines adopted this method of strengthening the poles because the rusting at ground level had in many cases seriously weakened them. The concrete core permits the poles to furnish effective service until the steel shell has practically rusted away.

In the accompanying illustration a peculiar form of tamper is shown with a helical-shaped head used to tamp concrete after it is placed in the pole. Little tamping is required, this device being used to make certain that the concrete has settled as it should and to keep it from clogging the core while placing. The steel ladder and support which was designed to carry on this work is also shown. Reinforcing poles in this manner has been practised for two seasons by the Chicago Surface Lines, and the work will be continued next year where poles are in such condition as to require attention.

Effect of Decreased Frequency on Operation of an Induction-Motor Generator Set

BY E. C. PARHAM

The immediate effect of operating a generator below its rated speed is to increase the amount of field current required in order to maintain normal voltage. This is due mainly to the fact that the maintenance of normal voltage under given load conditions requires that a certain number of field lines of force be cut each second by the armature conductors, and if the necessary rate of cutting cannot be obtained from the existing conductor rate of motion through the existing field, the field strength must be increased until the increase makes up for the lack of conductor speed. If the field strength cannot be increased in proportion to the speed deficiency, voltage cannot be maintained at its normal value.

One effect of decreasing the frequency of the voltage that is applied to an induction motor is to decrease proportionally the speed of the motor and of its connected load. It follows, then, that if an induction motor is the driving member of a motor-generator set of which the driven member is a continuous-current generator, the effect of low frequency will be to reduce the speed of the set. If the speed decrease is too great, the generator field will not have sufficient margin to permit of maintaining normal voltage at full load—the load itself producing further speed reduction incident to the increase of the amount of motor slip.

Such a situation developed where an operator furnishing fifty-cycle service specified, in ordering a small motor-generator set, a sixty-cycle motor because he knew that ultimately his service would require sixty-cycle operation. In ordering the sixty-cycle set for temporary fifty-cycle operation he had considered only the motor, and had felt safe in assuming that it could stand the larger current incident to operating on the lower frequency. The safety of such an assumption would largely depend on how nearly the motor would operate at its normal rating under the prospective load conditions and with the proper frequency. The point of interest in the present instance, however, is that when the sixty-cycle set was put into service it was found impossible to maintain the generator voltage at normal value even with the generator field rheostat resistance all cut out. In order to get out of the difficulty it was necessary to install upon the generator a set of shunt-field coils that had a greater number of ampere-turns.

Alternating-current motors are designed and are rated to stand a reasonable amount of departure from their voltage, current and frequency specifications, but before abusing them with eyes wide open it would be advisable for operators to ascertain the permissible limits of abnormal use.

Method of Supporting Zinc in Boilers to Prevent Corrosion

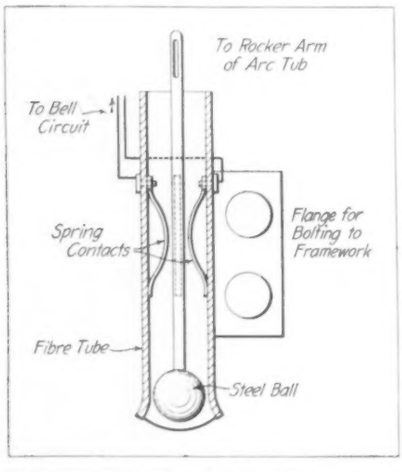
To prevent acid that may be in the feed water from corroding the boilers in the plant of the Young Men's Christian Association, Newark, N. J., about 60 lb. of zinc is distributed around the inside of each unit once every six months. For this purpose zinc castings are broken into blocks measuring about 1½ in. by 6 in. by 6 in. Several methods of supporting these blocks so they will not become attached to the shell and tubes have been tried. The best method experimented with so far has been to divide the zinc among cast-iron pots hung from the braces. The pots are about 12 in. in diameter and 10 in. deep.

It has been found that when the boilers are shut down the zinc has disintegrated and the remaining substance swollen until it fills or even heaps the pots. The contents seems to be a complex compound or mixture of compounds of calcium, magnesium and zinc. Probably part of this is precipitated by raising the feed water to boiler temperature, but the remainder is evidently caused by chemical combination of the zinc with impurities in the water. Pitting and scale have been considerably reduced by these measures.

A Telltale to Indicate a Faulty Arc-Light Transformer

The operator in a small substation often experiences difficulty in promptly noticing when a constant-current transformer or arc-light tub drops and the circuit goes out. Noise from rotaries or regulators prevents the operator from relying on the sound of the faulty tub. It is obvious, therefore, that prompt attention to a defective arc-light circuit is very desirable so that care should be taken to provide some means of indicating the interruption.

Where several tubs are fed from one plant the operator in the generating station can tell when a circuit is open by the falling off of the load as shown by the ammeter on the cable supplying the transformers. In the



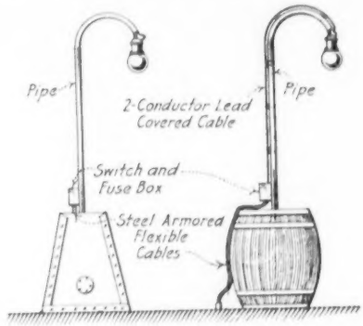
CONSTRUCTION OF AN INDICATOR TO SHOW WHEN ARC-LIGHT TUB DROPS OUT

substation the operator may notice an open circuit by closely watching the pilot lamp. It is impossible, however, for an operator to look after his regular work and pay close attention to the tubs. On account of this situation power companies find it advisable to equip tub transformers with a telltale device to indicate the opening of a circuit.

Many schemes are now in use, and the one illustrated here merely shows the general form and application for one arrangement. The device consists of a piece of fiber tubing held stationary against the framework. Inside the tubing a plunger made of a steel ball threaded on a rod moves freely. At the center of the tube four spring contacts are mounted, two for the bell-ringing circuit and two for the indicator. When the transformer is operating on the line, the plunger is below the contacts. If the tub coil drops, the plunger is drawn up, making contact with the clips, ringing the bell, and indicating which tub is out on the numerical indicator.

Inexpensive Lamp Standards Suitable for Many Occasions

Temporary street-lighting posts for use during special illumination and construction are shown in the accompanying illustrations as employed by an electric-



FIGS. 1 AND 2—SIMPLE BASES FOR LAMP STANDARDS

service company in one of our large cities. The post in Fig. 1 is used where appearance is important. The other is intended for use where the installation expense must be kept at a minimum and where special equipment is not available. The latter consists of a 2-in. iron pipe bent at the top to form a support for the lamp, with the lower end held in a vertical position in a barrel filled with broken rock and sand ballast.

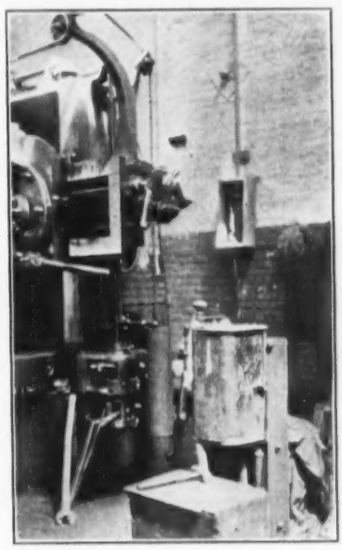
From the lamp to a switch and fuse box attached to the rod support just above the ballast is a lead-covered two-conductor cable. This may be made sightly by clamping or taping it to the rod support. The switch terminals may be connected with a service outlet from an underground system by a steel-armored cable.

The more elaborate standard requires the use of a special hollow sheet-metal base which may be filled with concrete, sand or gravel. The lamp support consists of a pipe through which the conductors are threaded to make them invisible. These conductors may terminate in a switch and fuse box which is connected with the electric-service system as previously described, or the conductors may continue through the base and connect with a concealed outlet.

The bases can be easily made by any sheet-metal worker if he is provided with patterns. The least amount of waste is insured when the panels are cut separately and provided with flanges for riveting together. With a circular hole cut in one of the inclined panels and provided with a cover which can be bolted in place, a base is provided which can be easily emptied of sand or gravel ballast. To prevent water settling inside the base and corroding it the upper part of the ballast may be covered with a sloping roof of fine concrete. Temporary supports of this description have been used on numerous occasions in New York City, including street entertainments and cases where streets have been torn up for construction purposes.

Improving a Boring-Mill Drive by Re-locating Motor Controller

In a large railroad shop a 54-in. boring mill driven by a 25-hp., 220-volt direct-current motor was first installed with the controller behind the tool. A study of the service rendered by the motor-driven equipment in



MOTOR CONTROLLER MOUNTED ON SPECIAL ANGLE-IRON FRAME FOR OPERATOR'S CONVENIENCE

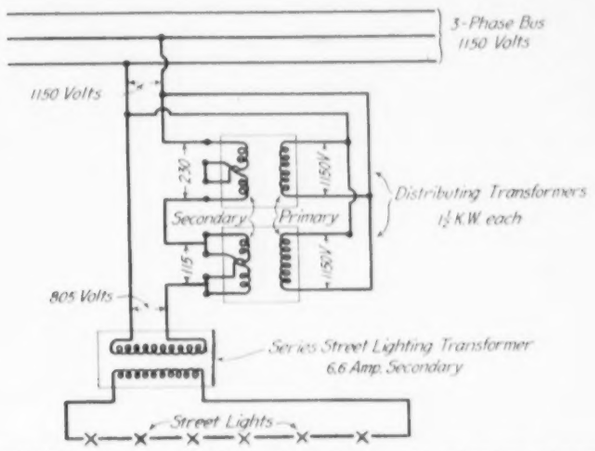
the shop led to the re-location of the controller on a 0.5-in. by 4-in. angle-iron frame at the side of the tool, as illustrated. The former location required 24 ft. of travel to and from the controller, whereas in the new location the controller is within 5 ft. of the operator's normal position.

Long-Handled Shovels Found Advisable for Forced Firing in Ohio Station

Feeding fires under boilers that are driven at 175 per cent rating is a hot job for the fireman. It was found, in fact, that men doing such work steadily at the plant of the Massillon (Ohio) Electric & Gas Company blistered exposed parts of their bodies. The company therefore provides all firemen with long-handled, square-ended coal shovels. A. V. Wynne, general superintendent for the company, says that with these shovels the men fire as efficiently as formerly.

How Distribution Transformers Were Used to Correct Line Voltage of Arc Circuit

The low power-factor of a series street-lighting transformer due to operation on small loads has been corrected in one case by the scheme shown in the accompanying diagram. The series street-lighting transformer had no percentage taps on the primary or secondary sides, so that when it served a fewer number of lamps than that for which it was designed the power-factor was so low as to make it necessary to operate a



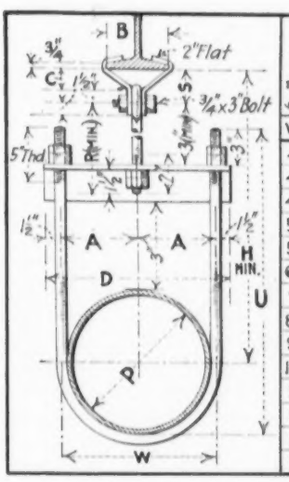
CONNECTION OF BUCKING TRANSFORMER TO IMPROVE POWER-FACTOR

larger generator than should be required with the transformer fully loaded.

By connecting two unused distributing transformers as shown to buck the primary voltage of the arc transformer, the power-factor of the series lighting load was raised and the load on the generator reduced by 8 amp. This reduction permitted the operation of the transformer on a smaller generator than previously. This scheme is being used by Paul E. Capraro, superintendent of the city water and electric light plant, Shawano, Wis.

A Convenient Form of Pipe Hanger

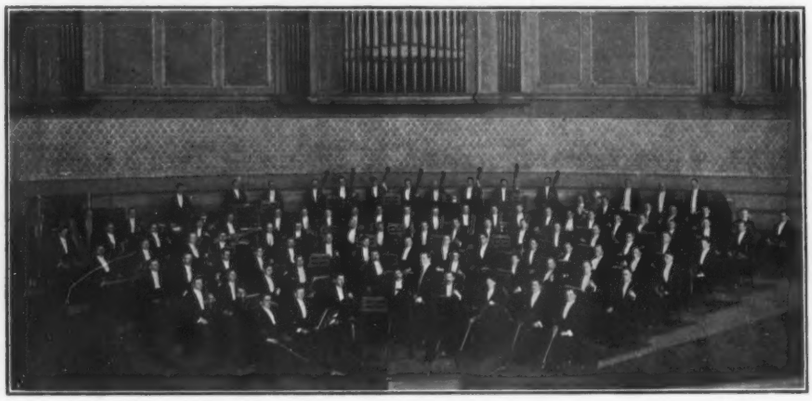
A form of pipe hanger and a table of dimensions to show how it may be made up to suit different conditions in a steam plant or factory building are presented herewith. The table gives sizes of standard parts that can be used for the different sizes of pipes that are to be supported.



"U" Bolt and Angle Dimensions				B	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	12	13	14	SIZE OF L	SIZE OF U-BOLT	SIZE OF ROD	THICKNESS OF CLIP
				C	1	1	1	1¼	1¼	1½	1½	1¾	1¾	2	2	2¼	2¼	2½	2½	2¾	2¾	3	3¼	3½				
				S	2½	2½	2½	2¾	2¾	3	3	3¼	3¼	3½	3½	3¾	3¾	4	4	4¼	4¼	4½	4¾	5				
				R	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½				
W	U	A	D	P	MINIMUM VALUES OF "H" WHEN "R" (MIN) = 4½"																							
4	11½	2	7	2½	12½	12½	12½	12¾	12¾	13	13	13¼	13¼	13½	13½	13¾	13¾	14	14	14¼	14¼	14½	14¾	15	2x2	⅝	⅝	5/16
4¼	12	2⅛	7¼	3	12¾	12¾	12¾	13	13	13¼	13¼	13½	13½	13¾	13¾	14	14	14¼	14¼	14½	14½	14¾	15	15¼	"	⅝	⅝	5/16
4¾	12½	2⅜	7⅜	3½	13	13	13	13¼	13¼	13½	13½	13¾	13¾	14	14	14¼	14¼	14½	14½	14¾	14¾	15	15¼	15½	"	⅝	⅝	5/16
5¼	13	2⅝	8¼	4	13¼	13¼	13¼	13½	14	13¾	13¾	14	14	14¼	14¼	14½	14½	14¾	14¾	15	15	15¼	15½	15¾	"	⅝	⅝	5/16
5¾	13½	2⅞	8¾	4½	13½	13½	13½	13¾	14¼	14	14	14¼	14¼	14½	14½	14¾	14¾	15	15	15¼	15¼	15½	15¾	16	"	⅝	⅝	5/16
6½	14½	3¼	9½	5	13¾	13¾	13¾	14	14½	14¼	14¼	14½	14½	14¾	14¾	15	15	15¼	15¼	15½	15½	15¾	16	16¼	2½ x2½	⅝	¾	5/16
7	14¾	3½	10	6	14¼	14¼	14¼	14½	15	14¾	14¾	15	15	15¼	15¼	15½	15½	15⅞	15¾	16	16	16¼	16½	16¾	"	⅝	¾	5/16
8½	16	4¼	11½	7	14¾	14¾	14¾	15	15½	15¼	15¼	15½	15½	15¾	15¾	16	16	16¼	16¼	16½	16½	16¾	17	17¼	"	⅝	¾	5/16
9½	17	4⅜	12½	8	15¼	15¼	15¼	15½	16	15¾	15¾	16	16	16¼	16¼	16½	16½	16⅞	16⅜	17	17	17¼	17½	17¾	"	⅝	¾	5/16
10½	18	5¼	13½	9	15¾	15¾	15⅞	16	16½	16¼	16¼	16½	16½	16¾	16¾	17	17	17¼	17¼	17½	17½	17¾	18	18¼	3x 2½	⅝	¾	5/16
12	19¼	6	15	10	16½	16½	16½	16¾	17¼	17	17	17¼	17¼	17½	17½	17¾	17¾	18	18	18¼	18¼	18½	18¾	19	"	⅝	¾	5/16
14	21¼	7	17	12	17½	17½	17½	17⅞	18¼	18	18	18¼	18¼	18¼	18½	18¾	18¾	19	19	19¼	19¼	19½	19¾	20	3x3	¾	⅞	⅜
16	23⅛	8	19	14	18½	18½	18½	18¾	19¼	19	19	19¼	19¼	19½	19½	19¾	19¾	20	20	20¼	20¼	20½	20⅞	21	3½ x3½	¾	⅞	⅜
18	25½	9	21	16	19½	19½	19½	19¾	20¼	20	20	20¼	20¼	20½	20½	20¾	20¾	21	21	21¼	21¼	21½	21¾	22	4x4	¾	1	⅜

CONSTRUCTION OF A PIPE HANGER AND DIMENSIONS OF PARTS TO SUPPORT DIFFERENT PIPE SIZES

Commonwealth Edison Orchestra Gives Monthly Concerts Gratis to Company's Customers



On the first Thursday of each month the orchestra of the Commonwealth Edison Company of Chicago is giving concerts which are free to the company's customers. At the first of these musical programs, conducted in Customers' Hall of the Edison Building on Dec. 2, 600 people were present in spite of the fact that this première had not been widely advertised. It is planned, however, that in the event that the crowds become larger than can be handled comfortably in Customers' Hall a limited number of tickets will be issued each month with customers' electric lighting and service bills. In Chicago and neighboring cities the Commonwealth Edison orchestra has won a reputation which classes this amateur organization well to the front among local musical organizations, both professional and amateur. Every player in the orchestra is an employee of the Commonwealth Edison Company. Its officers are: Morgan L. Eastman, conductor; W. L. Abbott, manager, and W. R. White, secretary and treasurer.

MARKETING ELECTRICITY

A Department on Selling Service and Widening the Use of Electrical Energy

Electrically Fitted Serving Table Given with $60 Worth of Appliances

Several interesting offers have been presented by the Merchants' Heat & Light Company of Indianapolis, Ind., in its campaign to introduce the use of electrical appliances among its residence customers.

One of the features of this company's appliance proposition is the offer of a very handsome serving table wired and equipped with three polished flush receptacles and given free with each appliance sale aggregating $60, provided that the purchase does not include an electric range or some such major apparatus. In a little booklet issued to the customers this table is described

THE ELECTRICALLY EQUIPPED SERVING TABLE WITH ITS THREE FLUSH RECEPTACLES

as "made in all woods and finishes—easily used in any room—a convenience at the breakfast table—a delight for summer evening teas—and indispensable in the sick-room." The table was designed and built in Indianapolis especially for this central station and contains two sliding shelves and a commodious drawer. It has proved so attractive to housewives that the acquisition of the table itself has often been the chief consideration of the appliance purchaser. Roy A. MacGregor is commercial manager of the Merchants' company and is responsible for both the tent demonstration and the electric table.

Leasing Motors on Trial-Service Proposition at Brockton and Abington, Mass.

For a number of years the Brockton (Mass.) Edison Company has made use of a trial-motor offer which has proved itself a deciding factor in securing many important motor-service contracts. The plan is applied only to prospective customers who are already using mechanical drive, for it is not considered necessary to offer a trial-motor installation to a new factory. Motors are furnished, however, for new factories on a lease plan originated to care for customers of from 1 hp. to 25 hp., who as a rule start business with little or no capital.

To protect the company against loss, a plate is attached to each motor thus leased, stating that the motor is the company's property. The customer is then required to sign a lease and makes a cash payment of 10 per cent of the cost of the motor, after 5 per cent has been added to the list price to cover interest. The balance is covered in eleven equal monthly payments.

Leading up to a trial proposition, the practice is first to interest the man at the head of the company, who, if the plan appeals, is in a position to accept it without referring it to anyone else.

With the consent of the owner or manager an investigation is then made of the power requirements, including methods of manufacture, arrangement of machinery, handling of products, etc.

Estimates of wiring cost are made by local contractors, the lowest bidder receiving the job. Failing to gain the prospective customer after a reasonable effort, the trial proposition is offered in order to convince him of the company's faith in its report.

The central station agrees to install at its own expense all electrical equipment required and to allow it

to be used for one year. The company does not, however, furnish belting and shaft pulleys, since these items can be cared for by the customer at little cost. It is figured that if at the end of the trial period the customer should be lost, second-hand belting and pulleys would be of little value, whereas the motors would have depreciated but little. The customer pays in equal monthly installments, as a rental, 15 per cent per annum on the total cost of the installation. The customer at the end of the year is the judge as to the value of the service, and if it is acceptable he agrees to purchase the equipment at cost less 60 per cent of the amount paid as rental.

Since 1906, out of trial propositions with a total connected load of 2500 hp., only one proposition (one of 115 hp.) has been lost. The cost to the company for these installations was $42,400, or an average of $16.96 per hp., all of which was returned with 6 per cent interest, with the foregoing exception. The average gross yearly income from this 2500 hp. has been $65,200, or $26.08 per horsepower of motor rating per year.

The Electric Light & Power Company of Abington & Rockland, another Stone & Webster property, has not yet lost a single installation of trial motors, and its connected power load has increased from 25 hp. in 1906 to 2810 hp. to-day, about 20 per cent of which was secured by the trial proposition. In 1906 the connected motor load of the Brockton company was 892 hp., with a yearly gross income of $15,021, and it is now 7641 hp., with a yearly gross income of $156,071, about 37 per cent having been gained by the trial plan.

A Place at the Cashier's Counter for Appliance Manufacturers' Literature

A manufacturer's representative at a recent electrical convention asked a group of central-station men, "Where do you keep the general advertising literature we manufacturers send to you?" Only one man present cared to answer the question. He said: "Of course, the majority of such material I receive is stored temporarily, but I always see to it that a complete line of appliances is represented in the boxes we have for such literature alongside the railing where our customers pay bills. I realize that manufacturers spend real money and thought to produce this advertising matter for us, and I want to put it where it will do the most good. From the boxes we have a customer can help himself to a booklet on any appliance in which he is interested. Sometimes our appliance salesman, watching customers, may see the trend of a man's or woman's interest and can complete a sale before the customer leaves the store."

Chicago Commission Merchant Uses Electric Heat to Facilitate Cutting Chilled Butter

R. Mangan & Company, a Chicago commission firm, have installed a 600-watt open-wire heater in a 10-ft. by 10-ft. by 6-ft. ice box, which is used for storing butter. The commission firm buys butter in large quantities and sells it in smaller lots. Consequently large pieces of butter must at times be cut into smaller ones. In the summer time no trouble is experienced in the process of cutting, but in the winter heat must be applied to bring the ice box temperature to about 70 deg. Fahr. before the butter can be parceled out at the desired speed. Application of the electric heater to this work has satisfactorily solved this problem in spite of the fact that the unit takes but 1 watt for each cubic foot of the space to be heated.

APARTMENT-HOUSE BILLBOARDS AT INDIANAPOLIS

Electric Billboards Announce the Coming Apartment House

The Indianapolis Light & Heat Company has instituted a billboard service for the proprietors of apartment houses which is meant to advertise their properties during the period of construction. As soon as the permit is issued for the erection of the building, a salesman from the Indianapolis company gets in touch with the owner and offers to erect an electric billboard advertising the building and also the fact that light and power will be provided by the "Indianapolis" company. It makes a most effective advertisement. This company already has about forty of these installations on circuit, dotting the city's outlying boulevards in a very impressive manner.

Electrically Lighted Traffic Signs at Mount Vernon, Ohio

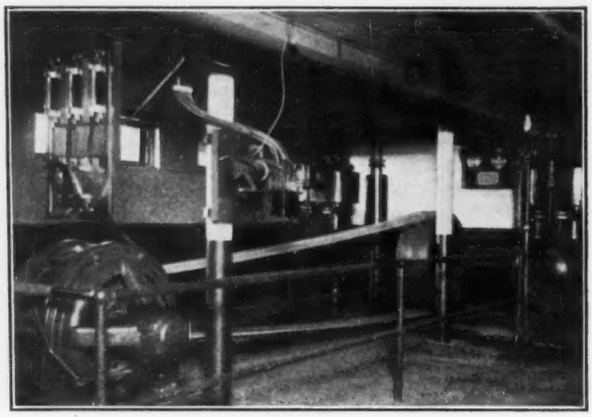
The accompanying illustrations show the electric-lighted traffic signs which have been erected at the four entrances to the public square of Mount Vernon, Ohio. Before these guides were erected it was necessary to keep two or more policemen on duty at the middle of the intersections every Saturday night to prevent the cutting of corners by passing vehicles. Several serious accidents also occurred at these places.

The standards are constructed of 1-in. conduit, to the height of the lamp arms, from which point there extends a 10-ft. piece of ¾-in. conduit connecting with the overhead 115-volt metered circuit. The 25-watt lamps are

ELECTRIC TRAFFIC SIGNS IN TOWN SQUARE

so arranged that both sides of the sign are properly illuminated. The injunction "Keep to the right" is plainly visible from both directions, and, according to A. J. Darrah, superintendent of the Ohio Light & Power Company, Mount Vernon, Ohio, the installation of these signs has created much favorable comment locally.

MOTOR-DRIVEN MEAT CHOPPER AND GRINDER



MOTOR-DRIVEN REFRIGERATING EQUIPMENT

Electric Service in Two Large New England Markets

Use of Motor-Operated Conveyors for Transporting Customers' Purchases Between Departments — Electric Refrigeration and Ventilation

Motor-driven belt conveyors for carrying packages from the counters to the shipping room are found to be an efficient means for handling customers' purchases in several New England food markets.

The large store of the J. B. Blood Company, Lynn, Mass., recently installed such a system, which consists in brief of a canvas belt 16 in. wide and 387 ft. long, running in a wood channel the length of the store, with three lateral belts of the same description, 150 ft. long, delivering to the main belt. This overhead system is at a height of about 8 ft. above the floor, within easy reach of the clerks, who toss the purchases upon the conveyor, which carries them to the shipping room.

A steel shaft running under the channel for the main belt is provided with pulleys for the travel of the lateral belts at their intersecting points. This shaft is rotated by a 5-hp. motor belted to a pulley on one end, and the same motor also operates two chute belts which convey goods up an incline to the shipping room. There are two 16-in. belts which convey purchases from the basement departments to the shipping room. These are each driven by a 5-hp. motor. A telephone-order conveyor, operated by a 4-hp. motor, delivers packages from a central point, where such orders are packed, to the shipping room.

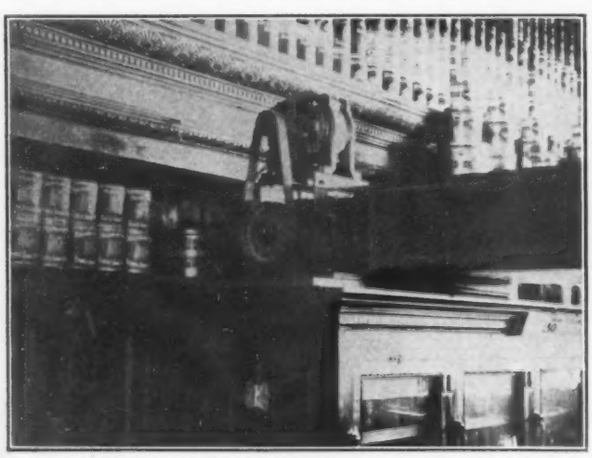
The store refrigerating plant consists of an 8-ton compressor for the ammonia system, operated by a 20-hp. motor, and two Remington compressors, for circulating refrigeration through a system of pipes under the edge of counter cases which contain meats and fish. These machines are operated with one as a stand-by, the motors being rated at 35 hp. and connected by a Morse chain.

Elevators in the store, of 4000-lb., 3000-lb. and 1000-lb. capacity, are operated respectively by 10-hp., 7.5-hp. and 5-hp. motors.

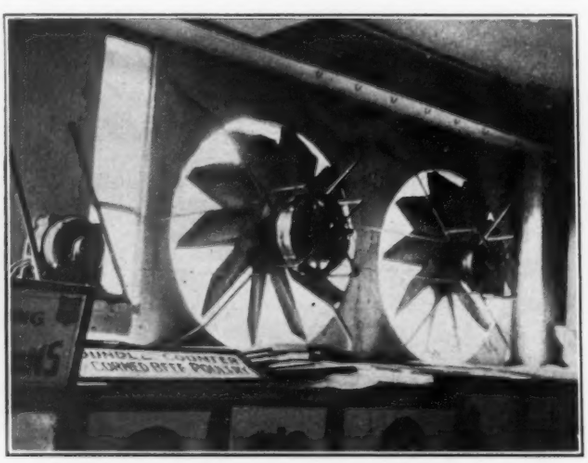
The bakery of the Blood store manufactures a large quantity of bread and pastry and is equipped throughout with motor drive. Forty persons work in the bakery.

A 5-hp. General Electric motor drives, from a counter shaft, a potato masher, a meat chopper, two vegetable slicers and a stale-bread grinder. Another 5-hp. motor operates a flour elevator, whence the flour goes to a Barbour bread mixer, water being applied by a rotary pump. A 2-hp. motor drives from an overhead shaft a dough weigher, a dough molder and a cooky machine. Three cake mixers are run by one 3-hp. motor, and an egg beater by a 2-hp. motor with variable-speed regulation. A 0.5-hp. motor is geared to a pie-crust roller, and another unit of the same size drives a ventilating fan over the ovens.

Other motored processes in the bakery are apple paring, cream beating, vegetable chopping and pie-plate washing, all performed by one 5-hp. motor. There are in all thirty motors, with an aggregate of 191 hp., all on 550-volt, three-phase service from the Lynn Gas & Electric Company. The prevailing rate of about 2 cents per kilowatt-hour makes electricity an economical source of power, and the business furnishes the central station with a profitable day load.



ARRANGEMENT FOR DRIVING BELT CONVEYOR FOR CUSTOMER'S PURCHASES



MOTOR-DRIVEN VENTILATING FANS IN THE MANHATTAN MARKET, CAMBRIDGE, MASS.

Another large store similarly equipped is the Manhattan Market, at Cambridge, Mass. Here are installed nineteen motors for various uses. An overhead carrier system, similar to that at Lynn, consists of two lengthwise 12-in. belts and two cross-lines, 12 in. wide. These are for conveying packages which are bought to be taken home by the purchaser, and they carry such articles, accompanied by the cash slip, to the bundle counter, where the purchaser claims his goods with a duplicate slip, paying for them at the cashier's desk near by.

A separate belt-conveyor system runs under the floor, with gravity chutes leading to it from each counter. This conveyor delivers onto a slow-moving belt making 50 ft. per minute, which runs between two tiers of shelves with compartments each bearing the number of delivery accounts, a corresponding number being conspicuously displayed on the charge slips attached to the packages. The main belt in the basement is 24 in. wide and 270 ft. long, and the slow-moving belt is 70 ft. long.

For the delivery of baskets of purchases to the wagons two 18-in. belt conveyors lead about 20 ft. up inclines to the loading platform at the rear of the store. The various belt lines are singly motored with units of from 5 hp. to 0.5 hp., according to the length and volume of goods each is designed to carry.

The application of 0.5-hp. motors to the 150-ft. cross belt, one in connection with each system, is by means of a reducing gear, recently devised by Edgar Hall, the company's machinist, for which a patent has been asked. By this means a motor which runs at 1700 r.p.m. is connected by a short belt to the drum over which the belt conveyor runs and within which are gears giving a speed of 75 ft. per minute to the conveyor.

Water is supplied to the condenser of an ice machine from a 320-ft. artesian well by means of a Dean plunger pump driven by a 15-hp. Westinghouse motor and delivering 40 gal. per minute. Two York compressors, each operated by a 15-hp. Westinghouse motor, produce refrigeration by the brine process, and a Dean double-acting pump, driven by a 10-hp. motor, circulates the brine through the showcases of the provision department.

Other motored apparatus are a meat chopper which is driven by a 3-hp. motor, a meat-slicer with a 0.5-hp. motor connected, and a set of two 40-in. ventilating fans which are driven by a 5-hp. General Electric motor.

A Suggestion for Electrical Publicity at Luncheons of Local Business Men

When an opportunity for unobtrusively presenting the advantages of the domestic applications of electricity forcibly to 150 of the community's leading business men —members of the local Rotary Club—came to F. A. Bryan, president and general manager of the Indiana & Michigan Electric Company of South Bend, Ind., he grasped that opportunity. When in rotation, as rotary clubs rotate, it became his turn to entertain, he had electric grills placed before the plates of all members, and inside the group of tables, arranged in a hollow square, he placed electric ranges. On the table and along its entire length ran a miniature railroad, from which an electrically propelled train distributed relishes, cigars, cigarettes and matches. During the week following the dinner there was a "run" on electric grills.

Small Motors Replace Compressed Air for Operating Railroad Safety Gates

At Hamilton, Ohio, fractional-horse-power motors are being used for operating safety gates at railroad grade crossings. It has been the common practice in most cities to operate these gates with compressed air, but the motors installed at Hamilton have proved so successful that negotiations are being made for changing the gates at Dayton and other cities to electric drive.

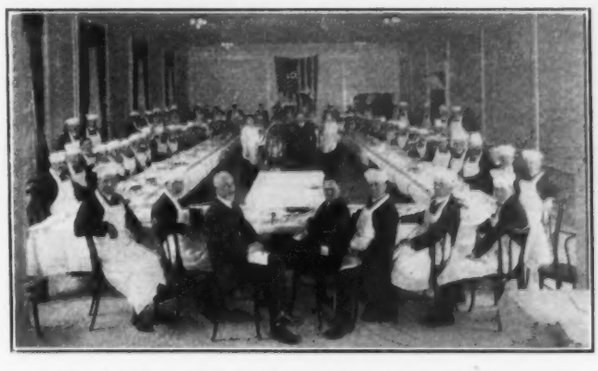
Watching Marriage-License Records for Prospective Appliance Purchasers

An enterprising electrical appliance salesman in a Western city keeps close watch on that part of his newspaper in which announcement of marriage licenses issued is made. Using the city directory and the telephone book, this salesman finds each bride's address and writes her a courteous letter giving real information on the use of electrical appliances in her home. He also suggests that certain appliances make beautiful gifts and—strange to say!—this information sometimes finds its way from the bride to persons buying presents for her.

Electric Sprinkling Wagons Converted Into Ash-Carts During Winter Season

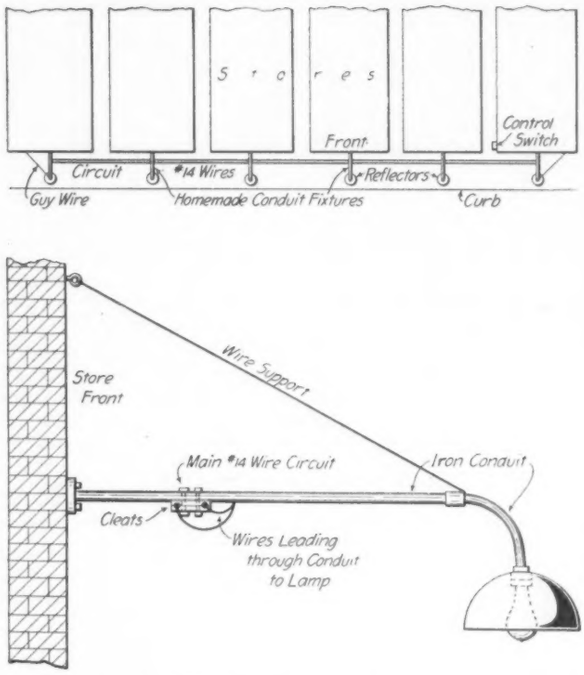
Early last summer the city of Lynn, Mass., purchased two 5-ton electric sprinkling trucks, each carrying a 1200-gal. tank measuring 13 ft. 10 in. long and 4 ft. 6 in. in diameter. An air tank, 2 ft. long, at one end of the main tank furnishes compressed air with which a street 85 ft. wide can be flushed, use being made of two nozzles.

With the close of the street-sprinkling season the tanks are removed from the trucks, and the bodies are converted into electrically operated ash wagons for collecting ashes and removing them to the public dumping grounds. Each truck is considered the equivalent of three double and two single teams for both sprinkling and ash-cart service.



THE SELF-COOKED ELECTRIC DINNER OF THE SOUTH BEND (IND.) ROTARY CLUB

ELECTRIC SPRINKLING CART AT LYNN, MASS., CONVERTED INTO ASH WAGON IN WINTER



STORE-FRONT FIXTURE RENTED BY LOGAN (OHIO) COMPANY

Rental Tungsten Fixture for Store-Front Lighting in Small Cities

At Logan, Ohio, a city of 4000 people, the new-business department of the Ohio Light & Power Company has had considerable success in lighting store fronts. The plan employed, as outlined by F. C. Morrison, the company's new-business manager, consisted, first, in adopting a fixture which can be made and installed for about $5 and in putting this fixture out on a rental basis. The fixture equipped with a 100-watt lamp is furnished and maintained for 50 cents a month, and energy for the lamp is sold at a flat rate of 1 cent a watt a month, gross. The fixtures are mounted on the building fronts and the lamp circuit, which is of No. 14 wire, is strung on cleats attached to the fixture. As a rule five or six of the fixtures are included in a circuit.

Metered Service Abandoned for Flat-Rate Schedule

The central-station properties of the Boston (Mass.) Electric Associates, including the Buzzards Bay Electric Company of Falmouth, Mass., and the Vineyard Lighting Company of Oak Bluffs, Mass., serve widely scattered groups of customers in the district between the island of Martha's Vineyard and Chatham, on the outside of Cape Cod. The properties distribute energy over an area of about 400 square miles and have about 2000 customers. Formerly metered service was generally employed, but the management found this unsatisfactory in view of the thinly settled territory involved, and it has adopted the flat rate in preference over the greater part of the systems. This year only 13 per cent of the customers on Martha's Vineyard island are on a metered basis and only 6 per cent of the total customers on the properties.

The rate is based on the connected load, fixed charges being apportioned over the four summer months. In winter there is a discount of 40 per cent from summer bills, which gives the permanent resident advantageous rates. The rates are 88 cents per month for a 20-cp. lamp, $1.50 per month for two 20-cp. units, $2.12 per month for three 20-cp. units, and 44 cents per month for each additional 20-cp. unit. From October to May inclusive there is a 40 per cent discount from these rates if the bill is paid before the 11th of each month.

According to the management, meters could not be operated, tested and read and bills figured for less than $5,000 in excess of present costs, and a meter and service could not be installed for less than $25 per customer. The demand is the important point, less than 25 per cent of the expense of service in these cases being energy cost. Over 1000 customers were recently checked for demand and station load, and there was not 3 per cent variation. Ultimately these customers will have to be placed on a limiting fuse. Extra flat rates are made for appliances.

Individuality in Dealer Advertising

Every manufacturer faces constantly the problem of how to give a flavor of individuality to the advertising helps that are sent to dealers for distribution locally. It requires clever handling, for instance, to make a stock folder exactly fit the situation in every dealer's territory, and obviously it is physically impossible to provide exclusive material for each local man.

A recent "dealer help" was prepared by the Western Electric Company for A. S. Green & Company, contractors of Westport, Conn., and it very cleverly affords that touch of personality that is so difficult to secure. The Westport fire regulations instruct the householder to send in an alarm of fire by telephone, and it is important that such messages should be both accurate and specific. A special fire-alarm card was therefore prepared, leaving blanks in which could be written the exact facts necessary for each person to specify in his urgent message in time of fire. These cards were then carefully filled in by Green & Company and distributed among the homes of Westport with full assurance that they would be appreciated and kept well in sight.

DEALER'S ADVERTISEMENT ON FIRE-ALARM CARD

TECHNICAL ADVANCE IN THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

An Electrically Conducting Paint

Treating Bronze Powder with Hydrochloric Acid to Produce a Paint Which When Applied Has Electrical and Physical Properties Approximating Those of a Continuous Metallic Foil

BY MAXWELL JAMES
Bureau of Standards, Washington, D. C.

METALLIC paints, such as aluminum and bronze, are non-conducting when applied in the usual manner. Bronze or aluminum powder itself is electrically non-conducting, owing probably to a film of oxide or fat around each metallic particle. Bronze powder may be cleaned by washing with concentrated hydrochloric acid, so that the particles cohere, and the powder then becomes conducting. This action of the hydrochloric acid on bronze powder has been made the basis of conducting paint.

Two methods have been employed to obtain a conducting paint film—one by treating a freshly bronze-painted surface with concentrated hydrochloric acid, the other by applying a paint that has been rendered conducting by mixing with the hydrochloric acid. The bronze paint used is a suspension of bronze powder in an amyl-acetate solution containing equal parts of amyl acetate and acetone and 4 per cent by weight of transparent celluloid. Rubbing a partly dry bronze-painted surface with concentrated hydrochloric acid renders it conducting. Exposing a freshly bronze-painted surface to the fumes of hydrochloric acid also yields a conducting film. The question whether the entire paint film thus exposed becomes conducting has been answered in the following way: Both sides of a piece of plate glass were painted and exposed to hydrochloric-acid fumes. On one side a circular strip of paint was removed, producing a guard-ring condenser with glass as a dielectric and with the painted surfaces as the metallic plates. Measurements of the capacity of this condenser gave a value for the dielectric constant of the glass which agreed with an independent measurement of the dielectric constant. The paint films thus acted as metallic plates. Although the entire paint film became conducting, measurements showed that the conductivity of the paint thus exposed to hydrochloric-acid fumes varied greatly from point to point over the surface.

SECOND METHOD—A READY-MADE CONDUCTING PAINT

The disadvantages of securing a conducting film by this means led to the second method, that of making a paint which when applied to a surface became conducting without further treatment. The following process yields a paint which combines the two essential factors of being conducting and having the covering property of a paint: Bronze powder is mixed with the amyl-acetate solution. Concentrated hydrochloric acid is then added and the mixture stirred until a paste is obtained. The hydrochloric acid is then washed out with water. The water is decanted and the paste mixed with ethyl alcohol until a suspension is obtained. The alcohol is then decanted and the residue mixed with the amyl-acetate solution until a uniform paint is effected. This paint, if applied soon after it is made, yields a uniformly conducting film. These paint films differ from the ordinary bronze-paint films in having the appearance of gold foil.

Tests were made to determine the resistivity and durability of these paint films. The results obtained are but qualitative. The surface resistivity of paint films about 0.05 mm. thick varied from 0.1 ohm to 1 ohm per square centimeter for different paint mixtures. In general, the finer the suspension obtained with ethyl alcohol the more uniform the final paint and the lower the resistance. Different grades of bronze powder gave practically the same results. Different surfaces, such as glass, wood, paper, cardboard and varnished cloth and wood, were painted, all except the varnished surfaces giving similar results. For the varnished surfaces the resistivity was very high. Solutions other than the commercial amyl-acetate solution of equal parts of amyl acetate and acetone gave various results. A solution containing two parts of amyl acetate to one part of acetone and 5 per cent of celluloid yielded a paint of good covering qualities having a surface resistivity of 0.1 ohm per square centimeter for a thickness of 0.05 mm.

EFFECT OF TIME ON RESISTANCE

The resistivity of these paint films increases with time. A definite cause for this increase has not been determined. The resistance of a paint film on a glass surface, when kept in the dark, showed an increase of 50 per cent in four months, while a similar surface exposed to sunlight showed an increase of 200 per cent in the same time. For the hard-wood surface the resistance of the paint film increased 300 per cent in four months, while for cardboard surface the resistance increased 500 per cent in the same time. For the varnished cloth the resistance increases very rapidly with time, being practically infinite at the end of four months. A varnished or shellacked wood surface has the same deleterious effect upon the paint. Varnish, shellac or any of the gums corrode the metallic particles. For this reason no other bronzing solution can be used except the solution containing amyl acetate, acetone and celluloid.

Recipe for the Conducting Paint.—To make the amyl-acetate solution* dissolve 5 grams of celluloid in 50 cu. cm. of acetone and mix with 50 cu. cm. of amyl acetate. To make the conducting paint mix bronze powder with amyl-acetate solution and add concentrated hydrochloric acid in slight excess. Wash with water and decant. Mix with ethyl alcohol until suspension is formed. Decant the alcohol. Add amyl-acetate solution and mix well.

Generators, Motors and Transformers

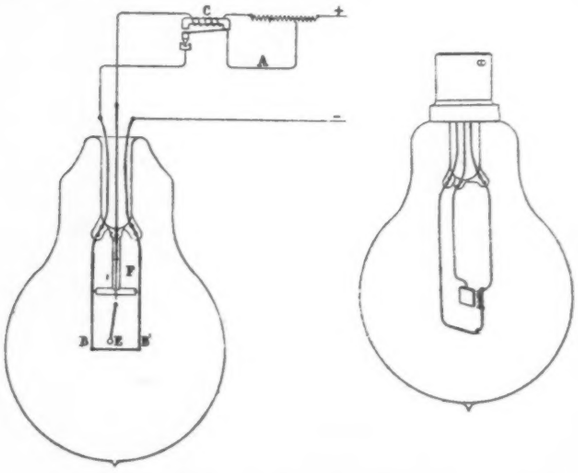
Mica-Insulated Armature Coils.—An editorial note on the advantages of mica as an insulating material. The mica used for armature-coil insulation has a greater factor of safety at 150 deg. C. than impregnated tape at 105 deg. C., and it shows no distress under conditions which quickly puncture treated tape, causing the latter

*Amyl-acetate solution is sold commercially as "banana liquid." The "banana liquid" put on the market lately should not be used in making the conducting paint, because the present commercial compound does not contain the proper ingredients.

to break down under severe operation. Moreover, mica shows a continuously increasing insulation resistance at temperatures above 200 deg. C., whereas treated tape breaks down structurally at temperatures higher than 100 deg. C. and the insulation resistance rapidly decreases. It has been found that this characteristic alone prevents the safe use of treated tapes and fabrics for the insulation of the armature of high-tension alternators and for temperatures above 100 deg. C. In the latest standardization rules of the American Institute of Electrical Engineers the ability of manufacturers to employ mica insulation successfully at maximum temperatures of 150 deg. C., and even higher, is recognized, but in the rules it is stated that as sufficient data covering experience over an extended period at such temperatures are at present unavailable, a temperature of 125 deg. C. has been adopted as a conservative limit for this class of insulation, and any increase above this figure should be the subject of special guarantee by the manufacturer. In the British standardization rules for electrical machinery a maximum observable temperature of 115 deg. C. is allowed for mica insulation for rotating machines wound for pressures not exceeding 5000 volts. For a machine other than a transformer, wound for a pressure exceeding 5000 volts, the limits of observable temperature allowed are reduced by 1.5 deg. C. for each 1000 volts or part thereof by which the rated pressure exceeds 5000 volts. Reference is made to the recent American Institute paper of F. D. Newbury, and it is said that by using suitable materials manufacturers need have no fear in giving the special guarantee called for when the maximum observable temperature exceeds that laid down by the several institutions.—London *Electrician*, Nov. 26, 1915.

Lamps and Lighting

Tungsten Arc Lamp.—E. A. GIMINGHAM AND S. R. MULLARD.—A communication to the *Journal* of the Institution of Electrical Engineers on a new arc lamp developed by the Edison and Swan United Electric Light Company of Great Britain. It is an arc lamp between tungsten electrodes in an inert gas such as nitrogen or argon. To start the lamp, an incandescent filament is used which, instead of being of pure tungsten, is composed of tungsten in combination with refractory



FIGS. 1 AND 2—RECENT TYPES OF TUNGSTEN ARC LAMPS

oxide such as zirconia, yttria or thoria. The filament has powerfully ionizing properties and is employed to ionize the gas in the gap between the electrodes, so that the arc can strike across. The arc is placed between two small globules of tungsten. In one of the later types of lamp developed (Fig. 1) three leads are necessary through the lamp stem; on one is mounted the electrode *E*, while the other two hold the filament, acting as an ionizer *BB'*. The positive main lead is divided into two circuits, one of which, *A*, passes through a resistance and the contacts on the electromagnetic switch *C* to one pole of the ionizer *B*, the

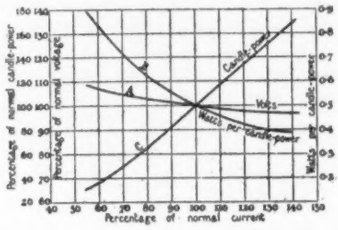


FIG. 3—VARIATION AND EFFICIENCY CURVES FOR TUNGSTEN ARC LAMPS

other being taken through a resistance and the coil on the electromagnetic switch to the positive electrode of the arc circuit *E*. The negative main lead is connected to the remaining ionizer lead *B'*. "In operation the current first passes through the ionizer circuit, causing the filament to incandesce at a temperature sufficient to ionize the gas between it and the positive electrode. At first a small current flows in the arc circuit, this current rapidly increasing until the cut-out is operated. This breaks the ionizer circuit and the arc is 'struck,' the striking being assisted by the removal of the ionizer circuit, which, of course, shunts the arc circuit. The heat rising from the arc causes the expansion strip *F* to warp, and this moves the arc to another position on the ionizer. On switching off the current the electrode returns to its original position, having left the inactive part and coming to rest opposite the still active portion of the ionizer. By this means the lamp may be restarted at any period of its life without difficulty. In this lamp practically the whole of the intense white light emanates from a small globule of fused tungsten 0.1 in. in diameter." Any size or shape of electrode may be made, the construction of the higher candle-power lamps being arranged as shown in Fig. 2. "Here the expansion strip is dispensed with, use being made of the fact that in the more powerful arcs there is a greater tendency for the arc to pass across the shortest gap. In this case, after striking from the filament to the edge of the electrode, the arc arises to the thickened portion immediately opposite. Another method adopted for controlling the arc stream in lamps of high candle-power is to employ an extra lead through the stem, holding a smaller electrode fixed between the positive plate and the filament and situated at a definite distance from the former. By the operation of change-over switches in the circuit an arc is first struck between the filament as cathode and the small electrode as anode. On this electrode becoming brightly incandescent the change-over switch quickly operated brings into the circuit the large plate electrode, at the same time breaking the negative connection to the filament and changing the polarity of the small white-hot electrode. This latter now being negative, an arc is immediately formed between it and the large positive plate. This arrangement enables electrodes of any size to be used, and the filament, being out of the circuit, is completely protected. A flat electrode is also employed. To obtain the best results a definite relation of surface to volume must be maintained. This type of lamp is made in sizes of 500 cp. to 1000 cp., the maximum intensity being given in a direction of right angles to the plane of the electrode." Curve *A* (Fig. 3) shows the percentage variation of pressure with current. As will be seen, the curve is similar to that for an ordinary carbon arc,

though showing greater stability. The pressure across the arc steadily decreases with an increase of current, and if this is continued until the sputtering point is reached, the pressure suddenly drops. A representative efficiency curve is given by *B* in Fig. 3, which shows the efficiency for the normal working current to be about 0.5 watt per international candle-power, or 2 cp. per watt. The current may be increased until the tungsten reaches the sputtering point, at which the efficiency is about 0.3 watt per candle-power, or 3.33 cp. per watt. Curve *C* in Fig. 3 shows the variation of candle-power with current. Lamps have been made with a life of 500 hours, and it is hoped that further experiment will make it possible to obtain a true half-watt lamp with a life of 800 hours. During life the average decrease in candle-power is about 10 per cent. Some experiments to determine the effect of varying the pressure across the supply mains show the arc to be very stable. A voltage drop of 20 per cent in the case of the small lamps and 25 per cent in the larger sizes was necessary before the arc was extinguished. The color of the light can be made to vary from a bright yellow when running at low efficiencies to a very intense white light when the lamp is run to the sputtering point of the electrodes. The range of intrinsic brilliancy between these limits is approximately 400 cp. to 30,000 cp. per square inch.—London *Elec. Review*, Dec. 10, 1915.

Traction

Electric Locomotive.—L. PAHIN.—An illustrated note on new electric locomotives used on various sections of Italian state railways which have been electrified in recent years, such as the Valteline-Monza line, two sections of the Giovi line, and the Mont-Cenis and Savone-Ceva lines. The three-phase system at 3000 volts and fifteen cycles is used. One type of locomotive employed has ten wheels, a rating of 2000 hp. and a weight of 60 tons. The two eight-pole motors, each of 100 hp., may be connected in parallel or cascade, the speed of the locomotive being 45,022 km. (27 or 30 miles) per hour. Another type of locomotive for express trains weighs 65 tons and has three motors. This type may run at four different speeds, 37, 55, 75 and 100 km. (22, 33, 45 and 60 miles) per hour respectively. The windings are so arranged that the motors may operate as three-phase or two-phase motors, the number of poles being eight or six respectively. For each case the motors may be connected in parallel or in cascade.—*La Lumière Elec.*, Nov. 15, 1915.

Installations, Systems and Appliances

German Central Stations in War Time.—B. THIERBACH.—A summary of the answers received from 183 German central stations in reply to an inquiry concerning the conditions in war times. Most of the stations state that they have not undertaken especial measures to increase the use of electricity because with the present scarcity of employees, copper, etc., in Germany it has been rather difficult to meet all demands for new installations. The rate of charging has been increased in Baden-Baden from 12.5 cents to 15 cents per kilowatt-hour for lighting, and in Karlsruhe from 10 cents to 12.25 cents for lighting and from 5 cents to 6.25 cents for motor service. The Burmbaum-Meseritz-Schwerin transmission system has increased the lighting rate by 1.25 cents. Six stations have decreased the rate of charging for special purposes. To facilitate electricity supply, eight stations have introduced flat rates and prepayment meters. The transmission systems in agricultural districts complain concerning the great reduction of the use of electricity for lighting. All stations complain about the difficulty of getting copper and other installation materials and about the scarcity of men. The power consumption in small shops has been reduced, but the power consumption in large factories has been increased on account of ammunition manufacture.—*Elek. Zeit.*, Nov. 4, 1915.

Wires, Wiring and Conduits

Variation of Alternating-Current Resistance of Iron Wires with Temperature.—W. PEUKERT.—The author discusses the variation of alternating-current resistance of iron wires with temperature on the basis of experiments. By comparing this resistance with the direct-current resistance he shows that the ratio of alternating-current to direct-current resistance decreases with increasing temperature so that for iron wires the "additional" joulean heat due to alternating current becomes smaller with increasing temperature. The numerical results are given in tables and diagrams.—*Elek. Zeit.*, Nov. 4, 1915.

Electrophysics and Magnetism

Alpha Particles from Thorium Active Deposit.—A. B. WOOD.—An account of an experimental investigation of the velocities of the two groups of alpha particles (ranges 4.8 cm. and 8.6 cm.) expelled from thorium active deposit. The mean value of the ratio of these velocities is found to be 1 : 0.832, whereas the value calculated from Geiger's relation gives 1 : 0.826. To explain this difference it is suggested that the value 4.8 cm., previously accepted as the range of alpha particles from thorium *C*, should be increased to 4.95 cm. No evidence has been obtained indicating a difference of mass of the two sets of alpha particles.—*Philos. Magazine*, November, 1915.

Magnetic Theory.—E. H. WILLIAMS.—A paper on the saturation value of the intensity of magnetization I_m. Experiments show that combining pure iron for which the value of I_m is 1800, when the iron is melted in a vacuum, with cobalt for which the value of I_m is 1500, when melted under the same conditions, an alloy is obtained for which I_m is 2050, or 14 per cent higher than for pure iron itself. The author uses his experimental results to test J. Kunz's mathematical theory of the energy of the hysteresis loop. He finds that the experimental results agree very well with the formula.—*Phys. Review*, November, 1915.

Units, Measurements and Instruments

Testing Iron.—N. W. MCLACHLAN.—A brief note on the mathematical investigation of the distortion of voltage waves obtained in testing iron.—London *Electrician*, Nov. 19, 1915.

Adjustable Condenser.—H. CHIREIX.—An article illustrated by diagrams describing a continuously variable condenser which permits the construction of a wave-meter for wireless telegraphy with a scale proportional to the wave-length. The condenser consists of two disks of which one is movable around an axle with respect to the stationary disk. The stationary disk is formed of a half circle. The movable disk is of smaller size and differs from a half circle by rounding off one end according to a certain formula.—*La Lumière Elec.*, Oct. 23, 1915.

Telegraphy, Telephony and Signals

Wireless Telegraphy.—J. A. FLEMING.—An abstract of a lecture on science in the war and after the war. The author deals especially with the difficulties in using wireless telegraphy in connection with aeroplanes and airships. The importance of engineering in large-gun construction is pointed out.—London *Electrician*, Nov. 12, 1915.

P. M. LINCOLN

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Paul M. Lincoln, whose connection with the Westinghouse companies in their operating and engineering activities extends back more than twenty-three years, becomes associated Jan. 1 with the sales organization of the Westinghouse Electric & Manufacturing Company with the title of commercial engineer. Mr. Lincoln retired on Aug. 1 as president of the American Institute of Electrical Engineers. He is also a well-known writer on technical subjects and has been identified with educational work, occupying the chair of professor of electrical engineering of the University of Pittsburgh. Mr. Lincoln was graduated from the Ohio State University at Columbus in 1892.

J. H. Grassman has resigned as director and assistant secretary and treasurer of the Electric Properties Corporation of New York.

H. M. Byllesby has been appointed a member of the public service corporation committee of the Investment Bankers' Association of America.

J. E. Hauser, sales engineer for the National Carbon Company, Cleveland, Ohio, was recently elected president of the Cleveland association of the alumni of Purdue University.

B. G. Tarkington, formerly salesman with the Public Service Company of Northern Illinois, is now power engineer with the Hodenpyl-Hardy Company at Jackson, Mich.

A. B. Gates, formerly assistant operating engineer for the Sanitary District of Chicago, is now associated with Gardner S. Williams, consulting engineer, at Ann Arbor, Mich.

H. F. Prichard of the engineering department of the Sanitary District of Chicago has been made assistant operating engineer to fill the vacancy left by the resignation of A. B. Gates.

Lynn R. MacBroom, formerly electrical engineer and general superintendent of the Rutland (Vt.) Railway, Light & Power Company, is now manager of the electric-light department of Burlington, Vt.

Dr. G. E. Magnusson, professor of electrical engineering at the University of Washington, Seattle, Wash., has been elected chairman of the Seattle Section of the American Institute of Electrical Engineers.

C. L. Stone, who has been appointed second vice-president and general manager of the Colliers Light, Heat & Power Company and the Hartwick Power Company, Cooperstown, N. Y., was formerly vice-president and general manager of the Manila Electric Railroad & Light Corporation, Manila, P. I. Since 1904 he has been connected with the J. G. White Management Corporation, New York City. Mr. Stone went to Manila for the J. G. White interests before the electric railroad and lighting property there began operation, and had charge of a considerable amount of construction work. Operation in Manila was started in 1905 and Mr. Stone was appointed electrical engineer of the property. Later he was made assistant general manager of the Manila Electric Railroad & Lighting Company, in which capacity he served for five years. He was vice-president and general manager of the properties for approximately two years prior to his departure from the Far East.

Bayard W. Mendenhall has resigned as sales superintendent of the Salt Lake City division of the Utah Power & Light Company to enter business for himself. Two years ago Mr. Mendenhall organized the Electric Specialty Company, which makes a line of electrically heated chicken and bacteriological incubators, and he will now devote his entire time to the interests of that company. Mr. Mendenhall entered the employ of the Utah Light & Railway Company in the fall of 1905 as power salesman, and he has been with that company and its successor continuously ever since, except for one year spent at Ely, Nev., as manager of the Ely Light & Power Company. Since May, 1908, he has held the position of commercial agent for the Utah Light & Railway Company and of sales superintendent for its successor, the Utah Power & Light Company. Mr. Mendenhall was graduated in electrical engineering from the Massachusetts Institute of Technology in 1902 and spent the next three years in the Stone & Webster organization.

John H. Roemer, who resigned as chairman of the Wisconsin Public Utilities Commission to become head of the law firm of Cummins, Roemer, Milkewitch & McKenna, Chicago, which has charge of the legal work for H. M. Byllesby & Company, was born in Clarington, Ohio, April 26, 1866. After being graduated from Marietta College in 1887 with the degree of bachelor of arts, he took up the profession of teaching and was principal of Linsley Institute at Wheeling, W. Va., for two years. Here he read law during his spare time and later resigned his position with the intention of entering Yale to pursue the study of law, but was persuaded by the Board of Regents to become head of the State Normal School at Fairmont, W. Va., for a year. Graduating from the Yale Law School in 1892, he went West and located in Milwaukee, where for four years he was connected with the firm of Van Dyke & Van Dyke. In May, 1899, Mr. Roemer became senior partner in the firm of Roemer & Aarons of Milwaukee, a partnership that continued until his appointment as Railroad Commissioner of Wisconsin in 1907. Upon the resignation of Chairman B. H. Meyer, who was appointed by President Taft to the Interstate Commerce Commission, Mr. Roemer was elected chairman of the Wisconsin commission, and at the expiration of the term for which Mr. Roemer was appointed Governor McGovern reappointed him for another term of four years. During his connection with the Railroad Commission of Wisconsin Mr. Roemer prepared several important articles on state regulation of public utilities and gave a course of lectures on the subject at the University of Wisconsin. He has also rendered valuable service to other states in the establishment of utilities commissions similar to that existing in Wisconsin.

J. H. ROEMER

Obituary

W. C. Anderson, vice-president and manager of the Canton (Ohio) Electric Company, died at Canton, Dec. 22, following an operation. Mr. Anderson was a past-president of the Ohio Electric Light Association.

Arthur William Wright, professor of experimental physics at Yale University from 1872 to 1906, died at his home in New Haven, Conn., on Dec. 19, in his eightieth year. He was graduated from Yale University in 1859. He was professor of physics and chemistry at Williams College from 1868 to 1872 and served as consulting specialist of the United States Signal Service for five years up to 1886. He was said to have been the first American investigator to obtain definite results from X-ray experiments. From 1883 to 1906, when he retired as professor emeritus, he was in charge of the Sloane Physical Laboratory at Yale, which was built from his plans and under his supervision.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

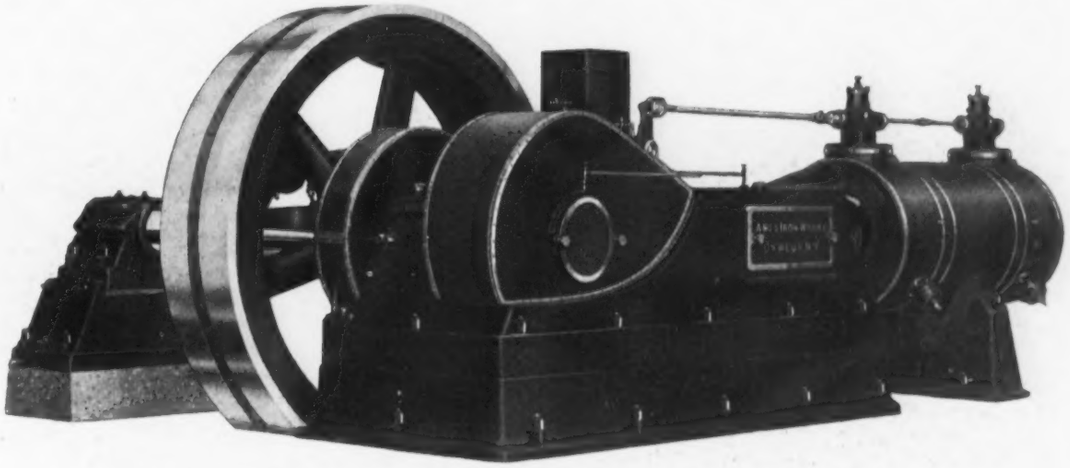


FIG. 1—ONE OF TWO UNA-FLOW ENGINES IN THE QUITMAN (GA.) MUNICIPAL LIGHTING PLANT

Una-Flow Steam Engines for Electric-Plant Operation

The efficiency of the una-flow steam engine for driving electric generators under a wide range of operating conditions and loads, both condensing and non-condensing, is so great that it has worked its way into general use in foreign countries, especially in Germany, where it is being employed not only in industrial plants for a variety of purposes, but also on railways to operate locomotives.

In una-flow engine cylinders internal condensation is practically eliminated, as the heads are kept hot by the admission of steam at high pressure and by the heat of compression, while the exhaust ports are never exposed to the hot steam. There is, therefore, little transfer of heat and waste. Steam is admitted to the cylinder of this engine by double-beat poppet valves at each end and leaves through central ports shown in the longitudinal section in Fig. 2. These ports open directly into a central exhaust compartment encircling the cylinder, from which direct communication is made with the exhaust pipe or condenser connection.

In the accompanying illustrations are shown units of the una-flow type, the design of which has been based on patents of Prof. Johann Stumpf of Berlin, Germany. These engines were made by the Ames Iron Works, Oswego, N. Y. The engine illustrated in Fig. 1 is one of two units installed in the Quitman (Ga.) municipal lighting plant, each of which is directly connected to a 312-kva. General Electric alternator. Each unit is 20 in. by 22 in. and operates at 200 r.p.m. with a pressure of 165 lb. per square inch., 26-in. vacuum and steam

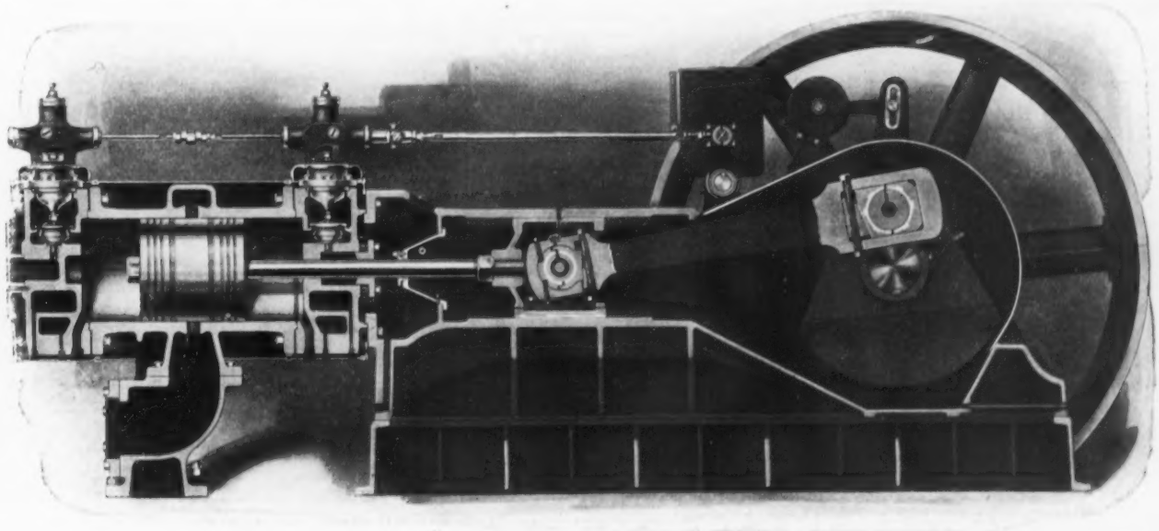


FIG. 2—LONGITUDINAL SECTION OF UNA-FLOW ENGINE, SHOWING POPPET VALVES AT ENDS OF CYLINDER

superheated 100 deg. Fahr. One of these engines in a test under the above-named conditions showed a steam consumption of 12.4 lb. per indicated horsepower per hour at one-quarter load, 11.5 lb. at one-half load, 11.2 lb. at three-quarters load, 11.6 lb. at full load, and 12.5 lb. at 25 per cent overload.

steam superheated from 50 deg. Fahr. to 90 deg. Fahr., and running at a speed of 260 r.p.m., and obtained a steam consumption as low as 11.7 lb. per indicated horsepower per hour. The engine was rated at 190 hp. at full load, and the highest economy was obtained at about 100 hp. The actual friction load of the engine

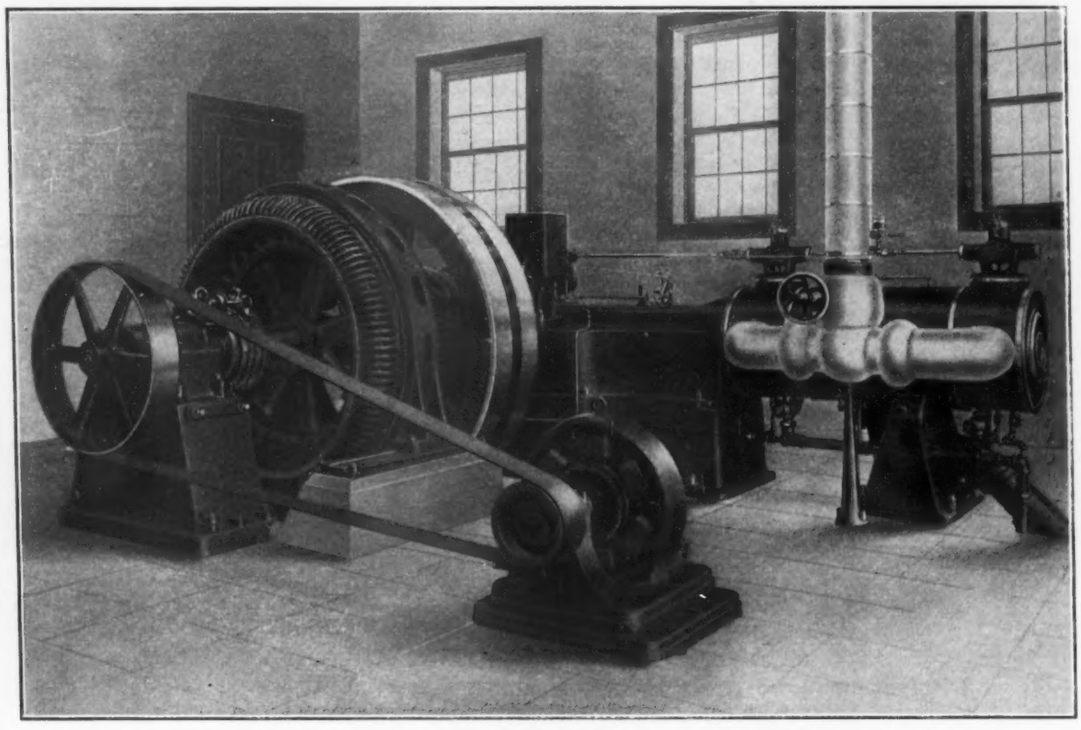


FIG. 3—UNA-FLOW ENGINE OPERATING 250-KW. GENERATOR IN PLANT OF WINDSOR (VT.) ELECTRIC COMPANY

The engine shown in Fig. 3 is installed in the plant of the Windsor (Vt.) Electric Light Company and drives a 250-kw. Allis-Chalmers generator. The unit is 18 in. by 24 in. and, operating under a pressure of 140 lb. per square inch, with steam superheated 108 deg. Fahr. and 23 in. vacuum, showed under actual tests a steam consumption of 12.4 lb. per indicated horsepower per hour at one-eighth load, 11.8 lb. at one-half load, 11.6 lb. at three-quarters load, and 12.6 lb. at full load.

Recently the Ames Iron Works tested a 125-kw. 16-in. by 17-in. unit operating with a pressure of 150 lb. per square inch, vacuum varying from 22 in. to 23.5 in., was 8.5 hp., as shown from the indicator diagram when operating under full speed and pressure.

Engines designed for condensing operation are equipped with automatic by-pass valves to prevent undue compression in the cylinder due to loss of vacuum. Use is made of a Robb-Armstrong-Sweet governor, which is carried in the flywheel.

In view of the fact that higher pressures make a possible economy in small engines, the design of the una-flow engine seems to promise interesting results in cases where working pressure up to 600 lb. per square inch can be used.

Cigarette-Case-Type Flashlamp

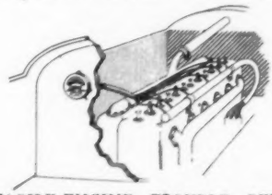
A flat-opening vest-pocket flashlamp of cigarette-case pattern has recently been placed on the market by the Anglo-American Company, 717 New Grant Street, Pittsburgh, Pa. The case is

FLAT-OPENING FLASHLAMP CASE

hinged and opens flat like an ordinary cigarette case and is provided with rounded corners without projections so that it will not wear out the pocket. With the flat-opening type of case, the manufacturer points out, difficulty in properly adjusting the contact when the battery is placed in the case is obviated, since when the case is opened the contacts are in plain view. The case is being made in two sizes, one being 3.125 in. by 1.625 in. by 0.875 in. and the other 3.75 in. by 2.625 in. by 1 in.

Electrically Operated Trouble Detector for Automobile Engines

A device brought out by the Lazarus Manufacturing Company, 746 Euclid Avenue, Cleveland, Ohio, is designed to indicate in which cylinder of a multi-cylinder automobile engine trouble exists. The device is inclosed in a nickel-plated case which is attached to the dash of the car. This "trouble detector," as it is called, is provided with a dial, 3 in. in diameter, with a series of window openings in a circle, each of which is consecutively numbered corresponding with the numbers of the cylinders. Terminals or contact points are arranged within the detector to correspond with the various openings. Use is made of an indicator hand by means of which the driver can ascertain in which cylinder trouble has developed.



AUTOMOBILE-ENGINE TROUBLE DETECTOR

Wires connect the trouble detector to each cylinder. The interior of the mechanism is embedded in an insulating compound. When irregularities develop in the engine, a center button is pressed inward, and the indicating hand designates which cylinder is affected.

Device for Washing and Cooling Air

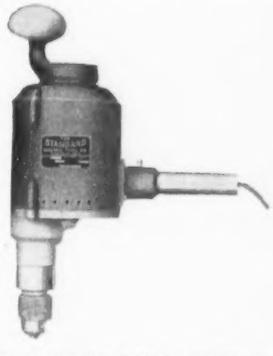
An attachment for an electric fan for cooling and washing air has been developed by H. R. Windmiller, 338 South Fremont Street, Los Angeles, Cal. The device consists of a metal drum just large enough in circumference to fit over the guard of a fan. At the lower part of the circle is a water tank which requires filling not oftener than once a day. Inside the drum is a series of blades, similar to those of a windmill, which are turned by the breeze of the electric fan, and as they revolve

ELECTRIC-FAN ATTACHMENT FOR WASHING AND COOLING AIR

the tip of each in turn enters and leaves the water tank. The blades are of wire netting which holds the drops of liquid in the mesh, so that a considerable amount of water is undergoing evaporation all the time the air current passes over it.

Light-Weight Electric Drill

The Standard Electric Tool Company of Cincinnati, Ohio, has developed and is now placing on the market what it calls its midget drill. The tool is made in three sizes. The 3/16-in. size weighs 6 lb., the 1/4-in. size weighs 7 lb., and the 5/16-in. size weighs 8 lb. The armature runs in ball bearings which are incased in grease in dust-proof chambers, and the chuck spindle is fitted



SMALL ELECTRIC DRILL WITH PLUNGER-TYPE SWITCH IN SIDE HANDLE

with thrust bearings. The motor windings are impregnated with bakelite and are ventilated by means of fans. A quick make-and-break switch of the plunger type is inserted in the side handle of the drill, placing it under the operator's control at all times.

This drill is designed and constructed on the unit plan and consists of only five parts. All electrical wires, connections and brush holders are incased in the drill frame. Either end cap may be taken off, and the tool can be easily dismembered without disturbing any electrical connection. Although the tool is light in weight, the manufacturer states that its design and construction are sufficiently rigid to enable it to stand rigorous continuous service.

Direct-Current and Alternating-Current Hand Starters

A line of direct-current and alternating-current hand starters with butt contacts has recently been developed by the Sundh Electric Company, New York. The direct-current starter shown

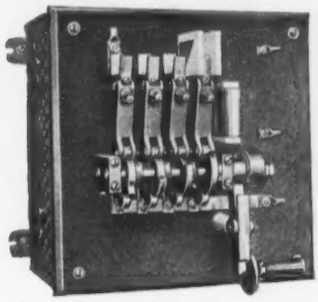


FIG. 1—DIRECT-CURRENT HAND STARTER

in Fig. 1 is of the multiple-switch type with no-voltage release. It is of rugged construction and has been designed to withstand severe service. All of the lever contacts are of the copper-to-copper butt-wiper type and have a blow-out effect on the current when breaking, thereby decreasing the arcing and burning of contacts. The cutting out of each step of resistance is accomplished by moving the operating handle upward. This handle moves a cam shaft, the cams being so set that the contact levers close in the proper order. When the last contact is made the operating lever, which has an armature pivoted on

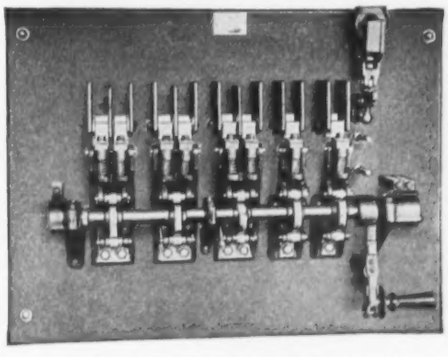


FIG. 2—HAND STARTER FOR ALTERNATING-CURRENT MOTOR

it, is held by the no-voltage magnet, and when low voltage occurs the operating lever swings downward, assisted by the action of a spring, and opens all contacts, reinserting all starting resistance in the armature circuit. The starter is so designed that it is impossible to close the contact levers in any but the proper sequence. By a special interlock it is also impossible to close them accidentally. They can be made to open or close only by moving the proper operating lever.

In Fig. 2 is shown an alternating-current slip-ring-motor hand starter equipped with low-voltage release device. It is of the cam-operated, butt-contact type. Both the primary and rotor circuits are operated by the movement of the handle. When the handle is lifted part way the primary circuit to the motor is closed and a further movement will short-circuit the motor resistor. When all resistance is cut out of the rotor the handle is held by the low-voltage release magnet. On failure of voltage the resistance is again inserted in the rotor circuit and the primary circuit is opened.

A Flood Lamp for Industrial Work

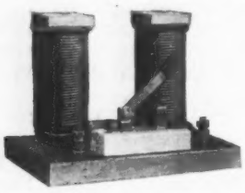
The American Lighting Company, 617 West Jackson Boulevard, has developed and is marketing a flood lamp called the "Sunlight flood." In this unit a 1000-watt gas-filled concentrated-filament lamp operating tip downward is held in a socket which can be adjusted

FLOOD LANTERN WITH 1000-WATT GAS-FILLED LAMP

to center the filament with the reflector. The reflector is also made adjustable so that the beam can be expanded or contracted from a broad beam of flood-light to a searchlight beam. In lamps used for stationary work the reflectors are of glass, but in outdoor construction outfits a non-tarnishing metal reflector is used because of the rough handling given such lamps. Both the lamp and the reflector are incased in a ventilated steel hood equipped with a wire glass front. The entire unit is hung on a universal bracket which permits it to be moved to right or left or up or down. The lamp is being used for flood-lighting building exteriors, construction work, clock towers, streets, railroad yards, factory assembling rooms, ice fields, bathing beaches, docks, levees, playgrounds, signs, night trap-shooting events, fair grounds, etc.

Re-magnetizing Device

A device for magnetizing permanent magnets, consisting of a powerful electromagnet mounted on a wooden base on which is a switch and two binding posts, as shown in the accompanying



DEVICE FOR RE-MAGNETIZING MAGNETS ON MAGNETOS

illustration, has been developed by the St. Louis Electrical Works, Arlington and Easton Avenues, St. Louis, Mo. The device may be operated by a 6-volt or 12-volt storage battery, or from dry cells if desired. Special pole pieces may be provided for charging Ford magnetos without removing them from the cars. The device weighs 8 lb. and measures 7 in. by 4.5 in. by 5.25 in.

Electric Range with Two Ovens

The electric range shown herewith is equipped with three heating elements on its top and with two ovens. Each oven is itself provided with two heating elements, and each element has three "heats," making it possible to obtain any of six different temperatures in each oven. The oven walls are well insulated, and food being cooked in the oven will remain at practically a constant temperature, it is claimed, for a considerable length of time after the current has been shut off. The ele-

ELECTRIC RANGE WITH THREE OPEN HEATING ELEMENTS AND TWO OVENS

ments employed on the top of the stove for frying and boiling, etc., may be of either the closed or open type. Equipment which is a combination of the closed and open type is also being made. The range is being placed on the market by the A. G. Electric & Manufacturing Company, 905 Howard Avenue, North, Seattle, Wash., and the Rialto Building, San Francisco, Cal.

Battery-Operated Lantern and House Lamp

Because of the fact that the case of the lantern shown in Fig. 1 is shaped like a mail box it is called "Uncle Sam's Mail Box" electric lantern. It is especially well adapted for use when doing chores about the house, garage or barn, and may be hung on the windshield of an automobile or the dashboard of a

FIG. 1—ELECTRIC "MAIL-BOX" LANTERN

buggy as a headlamp by means of the handle shown in the illustration. The lantern is provided with a green Patina finish and is operated by a three-cell dry battery. Lanterns of the same type are also provided in gunmetal or in nickel finish.

The electric house lamp or "night light," as it is called, which is shown in Fig. 2, is turned on by lifting up the handle. The circuit is opened automatically when the lamp is set down. In order to provide a permanent light, a screw on the handle may be turned. The lamp is 8.5 in. high and is of nickel-

FIG. 2—BATTERY-OPERATED HOUSE LAMP WITH SIDE HANDLE

plated brass throughout. It is equipped with a milk-glass shade, a three-cell battery and a tungsten bulb.

Both lamp and lantern are being placed on the market by the Lincoln Electric Works, 112 West Adams Street, Chicago, Ill.

Electric Popcorn-Vending Machine

A machine in which both popcorn and butter are heated electrically and in which the corn container is revolved and the heating element is oscillated by an electric motor is being marketed by the Lektric Sales Company of Logansport, Ind. The electrical equipment of the machine is controlled by three switches. One controls the lamps which serve as attention attractors and as the butter heaters. Another controls the flow of energy to the heating element. Still another controls the operation of the motor, but the motor must be in operation before the heater switch can be operated. Stopping the motor also stops the action of the heater, so that

CORN POPPER WITH OSCILLATING HEATING ELEMENT

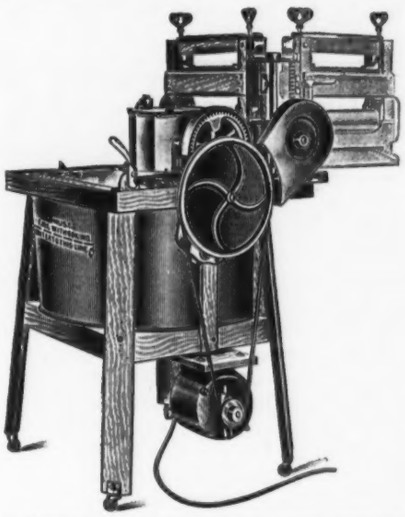
under no circumstances is the operator in danger of inadvertently burning a charge of corn.

Contrary to usual practice, the 1800-watt heating element in this machine is not stationary. Through a cam the 1/40-hp. Robbins & Myers motor drives the heater in the arc of part of a circle so that its heat is evenly over that portion of the corn container on which the unpopped grains lie. The cabinet complete stands 5.5 ft. high and occupies a 2-ft. by 2.5-ft. floor space. The machine will produce sixty 3-ounce bags of popcorn an hour.

Electric Washer of Vacuum Type

The motor-driven washer shown herewith is provided with a dasher with four spouts, which work up and down. The dasher shaft is hollow to permit air to be taken in at the top. A valve at the lower end of the dasher shaft is provided for taking in air at the upward stroke; the valve closes on the downward stroke, forcing the suds and hot water through the clothes. The body of the machine is of heavy solid sheet copper, polished on the outside and tinned inside. The wood in the legs, braces

and moldings is hard wood. All wood coming in contact with the water is red cypress. All gears are cut on automatic gear-cutting machines and are covered. Use is made of a web flywheel which

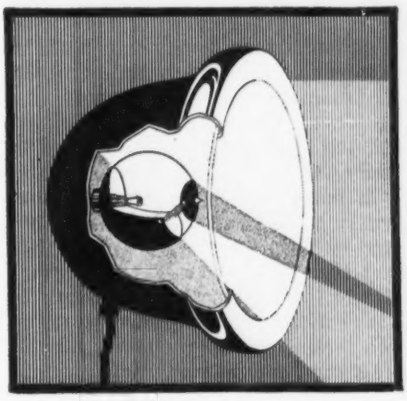


ELECTRIC WASHER WITH DASHER WHICH WORKS UP AND DOWN

covers all gears back of it. A lever is employed for controlling the wringer at the right hand of the operator and may be placed either in the forward or reverse or neutral position. A release device is also provided in case of accident. The wringer is driven by means of a high-grade bicycle chain. A faucet is provided at the bottom of the tub for draining the tub without tilting the machine. The motor is mounted beneath the tub as shown in the accompanying illustration.

Electric Automobile Lamp Reducing Glare

A device consisting of a thin aluminum shield which fits closely around the bulb of an automobile head-lamp and is held in place by means of springs has



AUTOMOBILE HEADLAMP EQUIPPED WITH ALUMINUM SHIELD FOR PREVENTING GLARE

been developed by the Perrin Manufacturing Company, Detroit, Mich., for reducing glare. As shown in the accompanying illustration, the device fits around the lower half of the bulb so that the light is concentrated on the upper part of the reflector and then is deflected downward on the road where it is desired. The shield cuts off the light which passes downward and which would be otherwise reflected into the eyes of drivers of other vehicles, causing the objectionable head-lamp glare.

Electric Siren

For creating general alarms in small towns, in factories, in public buildings, on ranches or at railway crossings the Federal Sign System (Electric), Chi-

FIG. 1—MOTOR-DRIVEN EXTERIOR-TYPE SIREN

cago, has brought out several types of motor-driven sirens. The use of the siren is being urged by the manufacturers to supersede bells and whistles

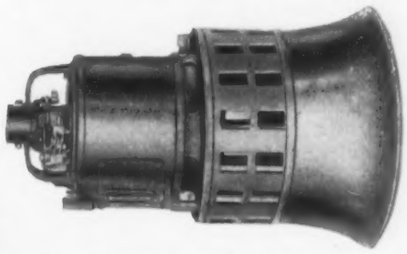


FIG. 2—MOTOR-DRIVEN INDOOR-TYPE SINGLE-HEAD SIREN

on the ground that its tone is unmistakable. While it is not necessarily the loudest of signals, it is distinctive and therefore eliminates the danger

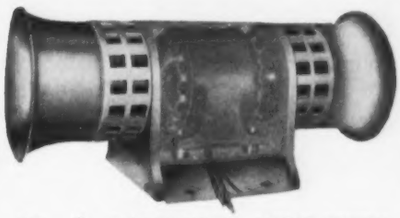
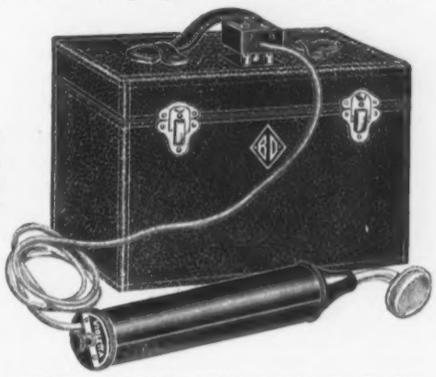


FIG. 3—DOUBLE-HEAD MOTOR-DRIVEN SIREN

from false alarms and alarm failures. The illustrations herewith show both the indoor and outdoor types and the large double-headed type. From the last-named type signals are clearly audible within a two-mile radius.

Portable Violet-Ray Outfit

By placing a condenser of high capacity in a special circuit with dry cells of large current output, the Bleadon-Dunn Company, 208 South Fifth Ave-

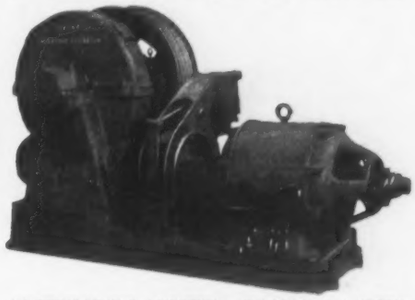


VIOLET-RAY SET OPERATED BY DRY CELLS

nue, Chicago, Ill., has produced a "violet-ray" outfit that will operate successfully without attachment to an outside source of energy. The machine, being portable, is suitable for use by physicians, barbers and hairdressers. The outfit complete weighs only 15 lb.

Elevator Motor

In order to adapt its alternating-current motors to elevator service, so that the cars may be stopped and started gradually, as is the case with direct-current machines, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has brought out a motor of the induction type, the rotor of which is provided with two windings, so that two speeds can be obtained. For low-speed service (250 r.p.m.) a twenty-four-pole winding is utilized, and for high-speed work (850 r.p.m.) an eight-pole winding is employed. Use is made of a five-point controller with "off," "low-speed" and "high-speed" forward and "low-speed" and "high-speed" reverse positions. A magnetic switch is provided, which gives practically the same effect as a dynamic brake, and which temporarily throws the motor on low speed when shutting off the power from the high-speed position. The motor develops a high torque at low speed with a starting current only 50 per cent above the



ALTERNATING-CURRENT ELEVATOR MOTOR

current at full speed with full load. The machine is being made in two sizes, with ratings of 25 hp. and 35 hp., respectively, at full speed. It is designed to operate the car at speeds of from 450 ft. to 500 ft. a minute.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Increase in Price of Electrical Apparatus

Prices of generators, motors, rotaries, transformers and other similar electrical equipment are beginning to move upward, many manufacturers having already made an advance of 10 per cent. This, from all indications, is only the initial step in greater advances to come shortly, due to increases in cost of material and labor. Those well informed expect a rise in prices of about 25 per cent before many months have passed.

Steel is hard to get, copper has been steadily increasing in price, and labor is restive in spite of higher wages and shorter working hours. Moreover, there is a demand for better deliveries on top of depleted stocks, so that conditions are ripe for a rising market. On the other hand, manufacturers claim that for some years now the profits have not been remunerative but have dwindled away almost to the vanishing point. In view of the present high prices for all raw materials and the difficulty in obtaining them even at these prices, and considering also the demands of labor for better wages and fewer working hours and ever-threatening labor strikes, it is impossible, it is stated, to continue the old prices and still leave a profit.

There has also been an advance in wire and cable, which has been caused almost entirely by the increasing price of copper.

Insuring the Employee

As the first of each year approaches corporations employing large numbers of wage-earners make plans for the more efficient working of their help through welfare means. One of the commendable means of bettering the conditions among employees is that of free insurance up to a limited amount. Many large manufacturing and industrial companies are already working along these lines and find the results eminently satisfactory. This year two electrical companies, one a manufacturing company and the other a central-station company, have already signified their intention of making provision for the insurance of employees.

The officials of the Robbins & Myers Company of Springfield, Ohio, have notified its employees that, in appreciation of the services rendered by all who have been connected with the company during the past year, a life-insurance policy has been taken out by the company for every employee. This policy is paid for by the company, and all annual premiums will also be paid by the company as long as the employee is connected with it. The amount of the policy increases with the length of time served, as follows: One year or less, $500; one year and under two, $600; two years and under three, $700; three years and under four, $800; four years and under five, $900; five years and over, $1,000. As soon as each employee's service brings him from one class into another, his insurance is increased automatically. In case an employee leaves the company at any time, the policy is canceled.

This insurance has been taken out with the Aetna Life Insurance Company and the policy took effect Christmas Day, the certificate to be delivered on Jan. 1.

A holiday gift has been made also by the Nevada-California Power Company in the form of a life-insurance policy upon the life of each of its employees—each policy being for the sum of $1,000. These policies are issued by the Equitable Life Insurance Society of the United States, and the premium upon each policy will be paid and the policies kept in force at the sole expense of the power company. Coincident with the announcement of this gift, the Nevada-California Power Company and its associate companies operating in Nevada and California have established a plan by which their employees will from the beginning of the new year maintain a hospital or sick benefit fund for the care and treatment of those among them who from time to time shall suffer illness or personal injury not sustained by accident arising out of and in the course of their employment. This means that the benefits to be had by employees from the use of this fund are entirely separate from the benefits conferred by the Nevada industrial insurance act and by the workman's insurance and safety act of California. To maintain this fund a nominal monthly contribution is made by each employee, depending upon the amount of monthly salary and in no case exceeding one dollar, and this contribution entitles him to receive medical and surgical treatment, with hospital care if necessary, including medicines in case of sickness or injury. The amount in each case is limited to $250. The creation of this fund is for the sole use and benefit of the employees, and the custody and administration of the fund will be entirely separate from the business of the company, but the latter will co-operate by supplying its facilities and the services of its officers to look after the general details of administration.

New Chicago Concern Aims to Revolutionize Transformer Manufacturing

As a result of investigation and research work covering a period of seven years and culminating in the construction and operation of a 1000-kw., 2200/1,000,-000-volt transformer at the San Francisco Exposition, experience has been gained which, according to C. H. Thordarson, will revolutionize the design and construction of high-tension transformers. To promote this work the Thordarson Transformer Company, Chicago, Ill., has been formed and some small 33,000/220/110-volt units are already being manufactured. These small units, which will permit transmission companies to serve small consumers directly from their lines, are 50 per cent lighter and at the same time are much less expensive to construct than the standard transformer types of to-day. It is not the new company's intention, however, to confine its activities to making small units, for the San Francisco tests have shown that units of high rating built along the same general lines may be successfully operated.

The new units, which are essentially of the shell type, contain several improvements. All windings are circular and none are interlaced. Consequently only radial stresses are produced in the planes of both the primary and secondary turns. The core, which is of the common-yoke type, is fitted together with patented butt joints. At the joints where the laminations of the yoke ends fit against those of the center core and

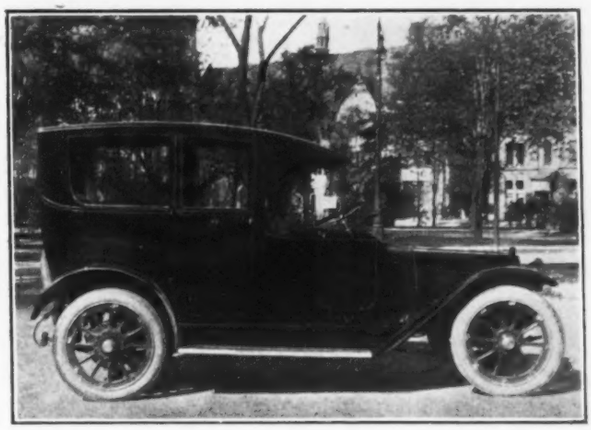
exterior magnetic paths V-shaped grooves and tongues are punched. These V-shaped tongues and grooves fit each other exactly and provide just twice the bearing surface that a common butt joint would give.

Next to the core the low-tension winding is placed. It is composed of coils of paper-insulated copper strips. The coils are insulated for 220 volts and are connected in multiple. A third grounded tap from these coils is brought out so that between it and each of the other two wires 110 volts is available. These coils are flat layer-like affairs and are so spaced and so supported that free oil space is available about each of them.

Outside this low-tension coil a cylindrical sleeve insulator is placed, and the primary coils are placed outside the insulating cylinder. Each of these coils is also layer-like and is placed to permit free oil circulation about it. The primary coils consist of bare strip metal some of which is only 1 mil in thickness. Specially prepared paper insulation somewhat wider than the metal strip is used. Automatic machines have been developed which handle this delicate metal foil and paper, cutting and winding it at rapid rates.

Electric Taxicabs for New York City

During the next week officials of the Detroit Taxicab & Transfer Company, now manufacturing and operating electric taxicabs in Detroit, will visit the East for the purpose of financing a new company to operate electric taxicabs in New York City. August Smith is president of the Detroit company and I. S. Scrimger is the secretary-treasurer and general manager.



TYPE OF ELECTRIC TAXICAB TO BE OPERATED IN NEW YORK CITY

One of the Detroit fleet of forty-seven cars has been in New York since the first of December and has been tested by all of the principal hotels, restaurants, clubs and other large users of taxicab service. The results show the electric taxicab to be acceptable to the New York public and further that it will operate successfully under the conditions of New York traffic. According to the present plans, the operation of the New York service will begin sometime in July with a fleet of more than 150 cars.

The new company to be formed in New York is the first step toward the formation of similar companies in other large cities in the United States. It is also expected that a holding company will be formed to control the separate operating companies.

It is expected that, owing to the high price of gasoline, which is now well above 20 cents a gallon and is expected to go much higher, and the decreasing price of electric energy, electric taxicabs will be able to compete more than successfully with gasoline machines.

Public Service Commission News

Ohio Commission

The Alliance Gas & Power Company, Alliance, has appealed an ordinance passed by the City Council last August to the Ohio Public Utilities Commission for adjustment. The ordinance provides for a service rate of 6 cents per kilowatt-hour for light. The company claims that no profit can be made at this rate and asks that an increase be permitted.

Pennsylvania Commission

The Pennsylvania Public Service Commission has refused to reopen an order denying a charter to the South Lebanon Electric Company, thus establishing a precedent for public service corporations in the State. The commission, according to the order, cannot limit corporate powers as suggested by the attorneys for the company; neither will it grant charter rights where the community is already being adequately served by an existing company.

New York Commission

Counsel to the Public Service Commission for the First District has submitted an opinion in regard to the effect of the commission's recent order directing electric companies to install a master meter or meters on the premises of one customer and forbidding the installation of more than one meter to a service under each contract. At the time this order was made the New York Edison Company had contracts with several of its consumers under which it agreed to maintain more than one meter on its customers' premises, and some of these contracts have several years to run. In accordance with the general principle that no contract can be carried into effect which, although legal when made, has become illegal by virtue of some subsequent law, counsel holds that the order of the commission, when it becomes effective, will abrogate all outstanding contracts made by the company which are inconsistent with the provisions of the order. The order goes into effect Jan. 1, 1916.

Idaho Commission

The Public Utilities Commission of Idaho has decided to rehear the application of the Swan Creek Electric Company for a certificate of public convenience and necessity to make certain extensions of its system around St. Charles, in the southeastern part of the State, which will bring it into direct competition with the Utah Power & Light Company. In granting the application for a rehearing the commission says: "A misapprehension seems to have arisen in regard to the grounds upon which the order granting said certificate was issued, and for the purpose of apprising the applicant and the intervenor as to the true issues in this cause in further proceedings we wish to state that the commission did not find in said opinion that the service rendered by the Utah Power & Light Company was unsatisfactory. On the contrary, however, the evidence was sufficient to satisfy the commission that the Utah Power & Light Company was rendering good service to its patrons in that community. The only vital question in issue in that hearing, and the ground upon which the commission ordered the certificate granted, was that from the evidence adduced at the hearing it appeared that the Swan Creek Electric Company had secured its franchise and had invested its money in good faith prior to the enactment of the public utilities law, and for that reason the commission felt that the investors in the Swan Creek company should be protected in their investment."

NOTES
ON ELECTRICAL TOPICS

Exposition Scintillator Projectors Purchased for Russian Army.—The banks of searchlamp projectors used to secure the "scintillator" effects at the Panama-Pacific International Exposition, San Francisco, have been purchased, it is understood, for the use of the Russian army in its operations in the European war.

New Light Rate Ordinance at Columbus, Ohio.—On Dec. 27 the City Council of Columbus passed the new ordinance, providing for a rate of 6 cents per kilowatt-hour, with a discount of 16⅔ per cent., making a net rate of 5 cents. It is anticipated that the Columbus Railway, Power & Light Company will refuse to accept the ordinance and will probably appeal to the State Public Utilities Commission. Engineers employed by the company are now making an appraisal of the property, and representatives of the commission are also engaged in the same work.

Youngstown Electric Signs May Have to Pay Additional Tax.—An ordinance is before the City Council of Youngstown, Ohio, under which an additional charge will be made for all electrical signs erected in the city besides that now made for the inspection of such signs. Several companies interested in the electric-sign business have complained of the proposed double charge, but the attitude of the city authorities is that each department is entitled to its fee for supervision and inspection and that separate charges for wiring permits and for the inspection of signs are therefore warranted.

Hull Municipal Plant to Be Abandoned.—At a special town meeting on Dec. 22 the citizens of Hull, Mass., voted unanimously to abandon the existing municipal electric-lighting plant and to purchase electricity from a private company. The Board of Selectmen was empowered to make a contract not exceeding ten years' life with a nearby central station, probably the Weymouth Electric Light & Power Company. The town hopes to save $7,000 a year by the change to central-station service. It is expected that a reduction in rates from 20 cents to 17 cents per kilowatt-hour for summer residents will result, with a scaling down of prices from 15 cents to 14 cents per kilowatt-hour for permanent inhabitants.

Buffalo General Electric Pays Rebates.—All rebates directed by the Public Service Commission have been paid consumers of electric light and power by the Buffalo (N. Y.) General Electric Company. The rebates amounted to $175,246. All refunds of $2 or under were credited to the account of the consumer and were deducted from the December bills. If the refund was more than $2, a check was sent covering the amount. The final order of the commission required the company to return to its consumers in discharge and cancellation of their refund certificates the moneys paid to it in reduction of its bills for motor service by the Cataract Power & Conduit Company. The refund received by the Buffalo General Electric Company from the Cataract company enabled the former company to refund to its customers 59.51 per cent of the amount of refund certificates issued.

Nobel Prizes for 1914-1915.—The Nobel prize for chemistry for 1914 has been awarded to Prof. Theodore W. Richards of Harvard University in recognition of his work on atomic weights. The prize for physics for the same year has gone to Prof. Max von Laue of Frankfort-on-the-Main for his study of the diffraction of light occurring in crystals. The 1915 prize in physics, which was incorrectly noted in these columns on Nov. 13 as having been divided between Thomas A. Edison and Nikola Tesla, has been divided between Prof. William Henry Bragg of Leeds and his son, Prof. W. L. Bragg of Cambridge. The 1915 prize in chemistry, which was incorrectly reported to have been awarded to Prof. Theodor Svedberg, was awarded to Dr. Richard Willstätter of the University of Berlin.

Damage to Pole Caused by Whittlers.—Idlers who have nothing to do find it extremely amusing to spend hours whittling poles. While an occasional shave or two would not have any noticeable effects, the continued practice weakens the pole in a short time and makes it very likely to fall in any heavy wind or sleet storm. Galvanized-tin coats have been suggested as a means to prevent such unconscious destruction of property. The accompanying illustration shows the damage done to a pole at Newberry, S. C. The illustration was furnished through the courtesy of the *Southern Telephone News*.

POLE GOUGED BY WHITTLERS AT NEWBERRY, S. C.

Work Now Started on Caney Fork River Plant.—The Tennessee Power Company has begun construction of the dam near Rock Island, Tenn., on the Caney Fork River, at which point the company will construct a 10,000-hp. hydroelectric plant. A large force of men will be put at work on the first of the year, according to statements made in Nashville. The company will use the power from this plant to supplement the power from the plant near Cleveland, Tenn., on the Ocoee River.

Copper Production in the United States.—The production of copper in the United States has increased more than twenty-five-fold since 1880. The production in 1913 was 1,652,000,000 lb., valued at $255,500,000. The world's production of copper is approximately 2,211,000,000 lb., of which the United States produces 60 per cent, Europe 13 per cent, Canada and Mexico 8 per cent, South America and Cuba 7 per cent, and all other countries 12 per cent. In 1913 the United States consumed about 41 per cent of the world's output of copper or about 65 per cent of her production from native ores.

Commission's Right to Interfere with Sale of Utility Properties May Be Questioned.—Motions have been filed in the United States District Court at Cincinnati, Ohio, by the Middletown Gas & Electric Company, the Franklin Electric Light Company, A. H. Walburg and J. A. Aull asking for the dismissal of the suit recently filed against them by Charles A. Monroe of Chicago to compel them to carry out a contract for the sale of the properties at Middletown and Franklin to him. They allege that the facts contained in Mr. Monroe's bill of complaint are not sufficient to warrant a decree. In his bill Mr. Monroe alleged that the defendants refused to carry out the agreement for the sale of the properties after the Public Service Commission had refused to approve the deal. The right of the commission to interfere with the purchase and sale of public-utility properties may be questioned in this case.

Ohio Commission to Modify Appraisal Order.—It is expected that the Ohio Public Utilities Commission will shortly issue a modification of its orders that all utility companies make complete appraisals of their properties and file the data with the commission. This can be done under an amendment made to the law last winter. The companies will either have more time in which to do the work or complete figures will be required only where the commission is asked to fix rates for service or approve them. A conference on this subject was held on Dec. 21, and it was attended by Attorney Thomas H. Hoggsett, representing a number of interurban railways; F. C. Dunbar, representing the telephone companies; J. C. Martin, representing water-works companies, and Attorney David Gaskell, representing electric light and power companies. They argued that making appraisals of many utilities is a needless expense and that the appraisals would be of no benefit to the commission or the companies.

Kansas City Rejuvenation.—Nineteen new members were taken into the Kansas City (Mo.) Jovian League at the Electrical Prosperity Week rejuvenation.

Detroit Engineering Society.—Alex Dow, president and general manager of the Detroit Edison Company, addressed the members of the Detroit Engineering Society on Dec. 11. His subject was "Electrical Energy, Wholesale and Retail."

Schenectady Section, A. I. E. E.—The 165th meeting of the Schenectady Section of the American Institute of Electrical Engineers was held at Edison Club Hall on Dec. 21, 1915. Dr. C. P. Steinmetz presented a paper entitled "Electric Conductors."

Chicago Electric Club-Jovian League.—The annual meeting of the Chicago Electric Club-Jovian League will be held at the Hotel Sherman on Jan. 7. The committee in charge includes G. H. Porter, chairman; H. E. Niesz, H. R. Bone, W. R. Pinckard, W. S. Taussig and P. R. Boole.

Philadelphia Jovian League.—At the regular meeting and luncheon of the Philadelphia Jovian League on Dec. 23 Theodore Fregiere, Mexican Consul-General at Philadelphia, spoke on "The Commerce of Mexico After the War." Rev. Lewis Bowman spoke at the meeting on Dec. 30, on "Modern Inventions."

Minnesota Section, A. I. E. E.—The Minnesota Section of the American Institute of Electrical Engineers held a meeting on Dec. 13 at the Heidelberg Café. H. C. Kimbrough, Western manager of the American District Steam Company of Chicago, read a paper on "District Steam Heating in Conjunction with Central-Station Operation."

Associated Manufacturers of Electrical Supplies.—There will be a meeting of the board of governors of the Associated Manufacturers of Electrical Supplies on Jan. 12, at the Hotel Biltmore, New York, at 8 p. m. At the same hotel and on the same day, at 3 o'clock in the afternoon, there will be a meeting of the section for molded or formed insulations.

New England, N. E. L. A., Section Convention.—The New England Section of the National Electric Light Association will hold a second "question box" convention March 8 and 9, 1916, at the American House, Boston, Mass. An electrical luncheon will be held at the American House on Jan. 6 to stimulate co-operation throughout the industry in New England. The headquarters of the section are at 149 Tremont Street, Boston.

Northern White Cedar Association.—The twentieth annual meeting of the Northern White Cedar Association will be held in the "Empire Room" of the Hotel Radisson, at Minneapolis, Minn., on Jan. 13 and 14, 1916. As has been the custom in years past, no program other than the usual order of business has been arranged. Among the topics to receive attention will be the matter of publicity for Northern White Cedar products, in line with similar action by allied lumber interests.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 71 of this number.

Lynn Section, A. I. E. E.—The next meeting of the Lynn Section, American Institute of Electrical Engineers, will be held on Jan. 5, when Dr. John A. Brashear, president of the American Society of Mechanical Engineers, will speak on "The Telescope." Besides the annual banquet, there will be four more meetings of the section during the present season. H. H. Barnes of New York City will be the speaker Feb. 2, W. D'A. Ryan on Feb. 16, M. Luckiesh on March 1, and Prof. Elihu Thomson at the final meeting on March 15.

Boston Section, Telephone and Telegraph Society of New England.—Adjutant-General Cole, M. V. M., and Captain Chase, chief signal officer, M. V. M., addressed the Boston Section of the Telephone and Telegraph Society of New England, on Dec. 28, on "Preparedness." The speakers explained to telephone and telegraph men how to prepare themselves to render the nation the most efficient military service in the time of need. It is proposed to meet once a week and be instructed by members of the Massachusetts Volunteer Militia in signal corps work.

January Conventions.—During the month of January conventions of interest to electrical men will be held as follows: Continuation of Pan-American Scientific Congress at Washington, D. C., Jan. 3-8; secretary-general, John Barrett, Pan-American Union, Washington, D. C. Electrical Contractors' Association of Wisconsin, annual convention, Hotel Wisconsin, Milwaukee, Jan. 17-19; secretary, Albert Petermann, 626 Lloyd Street, Milwaukee, Wis. Western Association of Electrical Inspectors, eleventh annual meeting, Hotel Sherman, Chicago, Jan. 25-27; secretary, W. S. Boyd, 175 West Jackson Boulevard, Chicago, Ill.

Society of Automobile Engineers.—At the annual meeting of the Society of Automobile Engineers, to be held at the Engineering Societies Building on Jan. 5 and 6, 1916, the following topics will be of interest to the electrical profession: Jan. 5 (morning session), report of electrical equipment division by A. L. Riker, chairman, and report of electric-vehicle division by A. J. Slade, chairman; Jan. 6 (morning session), "Electric Bulbs for Automobiles," by Henry Schroeder; (afternoon session) "Battery Versus Magneto Ignition," by Alexander Churchward, Frank Conrad and E. Gassman, and "Electric Lighting and Starting," by Joseph Bijur.

Electrical Development and Jovian League of San Francisco.—At the annual election of officers on Dec. 15 the following were chosen: President, E. M. Cutting, Edison Storage Battery Company; vice-president, C. C. Hillis, Electric Appliance Company; secretary-treasurer, J. W. Redpath, secretary California Association Electric Contractors and Dealers. The members of the executive committee are: R. M. Alvord, General Electric Company; R. F. Behan, Western Electric & Manufacturing Company; S. Waldo Coleman, general manager Coast Counties Gas & Electric Company, and S. A. Hamilton, Gas & Electric Appliance Company.

Illinois Manufacturers and Chicago Illuminating Men Meet.—Under the auspices of the safety committee of the Illinois Manufacturers' Association a program dealing entirely with factory illumination was presented at the association's meeting in Chicago on Dec. 15. Those who spoke were J. J. Kirk, Commonwealth Edison Company; G. C. Keech, Cooper Hewitt Company; O. L. Johnson, Benjamin Electric Manufacturing Company, and Ward Harrison, National Lamp Works of the General Electric Company. The program was prepared under the direction of E. W. Lloyd of the Commonwealth Edison Company and conducted by W. C. Berry, the Commonwealth Edison Company's claim agent.

Society for Electrical Development.—A number of changes have been made in the staff of the Society for Electrical Development. George B. Muldaur, who had charge of the field co-operative work, severed his connection with the society Dec. 15. H. W. Alexander, who is in charge of the editorial and advertising departments, will undertake part of the work formerly done by Mr. Muldaur, assisted by G. W. Hill. The publicity work of the society has been handled by J. T. Kelly, who will remain with the society and will, in addition to his former duties, undertake some of the work formerly handled by Mr. Alexander. C. H. Griffith, formerly with the McJunkin Advertising Agency in Chicago, has been engaged to prepare advertising copy, booklets, etc., as successor to C. Ridderhof. The Society for Electrical Development is continuing its regular work and has under consideration special plans for 1916.

Joint Meeting at Cleveland.—Charles F. Brush, of arc-light fame, and S. E. Doane, chief engineer of the National Electric Lamp Association, were the speakers at a joint meeting of the Cleveland Engineering Society, the Cleveland Section of the American Institute of Electrical Engineers, the Electrical League of Cleveland and the Cleveland Advertising Club at the Hollenden Hotel on the evening of Dec. 20. Mr. Doane insisted that the beauty of streets lies in unobstructed curb lines. The joint use of poles by public-service companies would enhance the beauty of the curb line, he said, and he suggested that mail and fire-alarm boxes and fire hydrants be set flush with buildings in order to relieve the curbs. "Don't clutter up the curb line" is a slogan equal in importance to "The sixth city," in Cleveland, he said. Both Mr. Doane and Mr. Brush spoke on the various systems of street-lighting and explained their advantages.

FINANCE, COMMERCE AND INDUSTRY

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Manufacturing and Industrial

Revival in Demand for Generators

"Enormous," "phenomenal," "record-breaking" are the terms in which the present business in generators is qualified by some manufacturers, although others state that the business, while good, is not extraordinary. For two years the demand for this class of electrical equipment was almost at a standstill. The reasons are not hard to find. To purchase a generator means the outlay of a large amount of additional money for the requisite auxiliary equipment, necessary driving apparatus and its auxiliaries, and, what is quite frequently the case, additional sources of primary power. Furthermore, installation costs assume considerable proportions, especially when additional building is required. Therefore to purchase a generator is a financial operation, and anything during the past two years which demanded new financing and which was not absolutely necessary was put to one side to await a better market for securities. Since the market for bonds with good security back of them is now rising and has the best of prospects, it has become safe again to take up development work that for the past two years has been stagnant. This, in brief, is the existing situation back of the present market for generators.

The demand, however, is not spread over the entire generator trade. As a matter of fact, the demand is particularly large only for steam turbo-generators. There is still but little call for hydroelectric equipment, and, moreover, it is felt that this situation will remain unchanged until there is definite legislation in regard to water-power that will attract capital in this direction. Until the present unsettled state of affairs is cleared up by Congress financiers will hesitate, it is believed, to put their capital into hydroelectric development.

The business from the isolated-plant field, while increasing, is becoming relatively smaller and smaller each year. Central stations are placing on their lines at a greatly increasing rate buildings and factories that formerly had plants of their own. One manufacturer said: "Where formerly we would have installed a generator we now in most cases install a transformer."

A further significant fact that was pointed out is the increasingly larger sizes of generators. Generators with a rating that a few years ago would have been termed impracticable, that engineers would have proved conclusively could not be used efficiently even though the load warranted it, are now almost in common use.

Deliveries are delayed, and while the present conditions exist will continue to be delayed. The iron and steel trade, besides being swamped with immediate business, is booked ahead to capacity for many months, with the result that it now takes months to get these materials. Copper is very difficult to obtain for anything like immediate delivery. Other raw materials are also delayed in delivery. In addition, the congested condition of freight service is causing delays in delivery of both the raw materials and the finished product. Labor scarcity and the action of organized labor are of such a serious nature as to be causing no small concern to many manufacturers. These circumstances, in addition to the crowded conditions in the manufacturing shops, are, as has been stated, the principal causes for delayed deliveries.

Increases in prices of raw materials, the law of supply and demand, increased cost of labor and production, and the demand for a fairer profit commensurate with the quality of the product, are also responsible for the increases in prices that have already gone into effect and the further increases which owing to conditions in the industry are bound to come in the near future. Already there has been an advance of about 10 per cent, and further advances are to be expected.

No change has occurred in credits. Collections so far as they relate to the large buyers have undergone no change, since collections from this source have always been good. From the small buyers, however, collections have improved materially and are now excellent. The reason for this is to be found in the vastly improved condition of the money market.

Robbins & Myers on Twenty-two-Hour Shift.—Beginning with Jan. 3, the factory of the Robbins & Myers Company of Springfield, Ohio, will be operated on a twenty-two-hour shift.

The Crocker-Wheeler Company, Ampere, N. J., has appointed C. A. Gauss publicity manager. Mr. Gauss was formerly associate editor of the *Electrical Review and Western Electrician* and news editor of the ELECTRICAL WORLD.

The Champion Carbon Company.—Announcement was made recently that the plant of the Champion Carbon Company at Loveland, Ohio, which was destroyed by fire about six months ago, will be rebuilt and that the company will be reorganized.

Order for Crossing Clamps.—The Illinois Traction Company has recently placed a repeat order with Edwin G. Hatch, 120 Broadway, New York, for a number of overhead protective crossing clamps, to be used at overhead three-phase line crossings.

The Central Station Equipment Company, 114 Liberty Street, New York, has been engaged by the Borough Council of Shippensburg, Pa., to revise the entire lighting system of the borough and to make recommendations as to the proper system to install.

F. W. Ballard & Company.—F. W. Ballard, light and heat commissioner, will open an office on the eighth floor of the Swetland Building, Cleveland, Ohio, on Jan. 1, as an expert in the appraisal of utility and industrial properties, as well as consulting engineering work. The firm which he has organized will be known as F. W. Ballard & Company.

The Doehler Die Casting Company of Brooklyn, N. Y., and Toledo, Ohio, has recently placed contracts for a new factory at Toledo. The addition will include 70,000 sq. ft. floor space and will consist of foundry, machine shop and offices. The company expects to have the buildings in operation May 1. The new plant will enable the company to give better service to its Western patrons than it was possible to do from its Brooklyn establishment.

The Electric Shop, Inc., 108 East Fourth Street, St. Paul, Minn., which is a dealer in electrical specialties and supplies, has recently been formed. Thomas Hall, who is secretary and treasurer of the Pioneer Electric Company, is president, R. M. Laird of the R. M. Laird Electric Company is vice-president, and J. E. Bryan, formerly manager of the St. Paul branch of the Sterling Electric Lamp Division, Warren, Ohio, is secretary and treasurer.

Tenney Interests Organize Electrochemical Company.—The Boston Electrolytic Oxygen Company has been organized by the C. H. Tenney central-station interests, under Massachusetts laws, with a capital of $150,000 to manufacture and sell oxygen and hydrogen gases. The plant will be established at Everett, Mass., and the officers of the company are: President, Palmer York; vice-president, D. E. Manson; treasurer, E. A. Bradley; assistant treasurer, H. A. Gidney.

The Railway & Industrial Engineering Company, manufacturer of Burke horn-gap switching and protective apparatus and outdoor substations, has moved its sales office to the People's Bank Building, Pittsburgh, Pa. L. C. Hart,

sales manager of the company, has arranged at the new offices an exhibit of Burke horn-gap apparatus, in addition to a very complete file of blueprints, photographs and data on the application of outdoor equipment.

Demand for 1-Kw. Turbo-Generators Among New York Tugboat Owners.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has inaugurated quite an extensive selling campaign to dispose of its 1-kw. turbo-generators to tugboat owners in the vicinity of New York. Circulars descriptive of the sets have been sent to the various owners, while actual sales of the sets are being made by the dry-dock people who act as middlemen. The small turbo-generators are becoming quite popular on the tugboats and are used exclusively for lighting.

Holophane Glass Company Resumes Control of Its Product.—The arrangements between the Holophane Glass Company and the General Electric Company under which the latter-named concern has had the exclusive right to manufacture and sell "Holophane" prismatic glass in the past few years terminated Dec. 31, and the Holophane Glass Company has resumed control of its products. The latter-named company has established temporary headquarters at 340 Madison Avenue, New York, and Otis A. Mygatt will act as president and C. Franck as sales manager. The company is working on several new kinds of glassware which will be placed on the market in the near future.

Information Desired Regarding Effect of Vibration of Structures.—Recognizing the fact that almost everybody is of the opinion that higher speed, better work and greater human efficiency are possible in a stable building as compared with a vibrating structure, but that exact data proving such is the case are difficult to obtain, the Aberthaw Construction Company of Boston, Mass., is undertaking an exhaustive investigation in the effort to bring together conclusive evidence. The company is especially desirous of obtaining suggestions or reports of experience regarding the matter which will assist in the collection of facts or the reaching of conclusions.

Allis-Chalmers Manufacturing Company Reimburses Employees for Previous Wage Cut.—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., recently mailed checks to its office employees whose salaries were cut a year ago owing to adverse business conditions. About 1000 men received checks which were for sums equivalent to the wages lost as a result of the cut. In a letter accompanying each check President Otto Falk said: "In the early part of this year business conditions with our company were so unsatisfactory that a reduction was made in your salary. The improvement has been such that it has been decided to reimburse this reduction to our present employees."

Prizes Awarded in New York Ward Special Campaign.—The two cups offered by Arthur Williams of the New York Edison Company for the winners of the Metropolitan district "Ward special" campaign were presented at the meeting of the New York Section of the Electric Vehicle Association of America on Nov. 28 to Edward Friend, winner in the New York Edison central-station salesmen's group, and to the New York team. The New York team was competing with the New Jersey team. During the campaign, which lasted from Oct. 1 to Dec. 4, there were sold in the metropolitan district, which includes Greater New York City and Newark, from twenty-five to thirty "Ward specials."

New Lighting System for Salt Lake City.—W. D'A. Ryan, chief of illumination for the Panama-Pacific International Exposition, appeared before the City Commission of Salt Lake City, Dec. 17, and explained to the members of the commission details for the special lighting system on Main Street which he has designed. The system consists of special ornamental posts, which will fit over and conceal the regular trolley poles. Each post will carry three 6.6-amp. inverted luminous-arc lamps. The standards will be spaced approximately 100 ft. apart on each side of the street for a distance of 4000 ft. The commission, after the conclusion of Mr. Ryan's remarks, approved the plans as submitted and instructed the recorder to prepare an advertisement to give notice of intention to make the improvement.

Business Good for Canadian Firm.—According to Mr. Mainer, president of the Mainer Electrical Company, Winnipeg, Can., one of the largest electrical contracting firms in western Canada, electrical utensils and fixtures are among the necessities that have held their own this year. Mr. Mainer also stated that the cash business done over the counter has been just as good as in any year before the war, and that the past three months have been considerably ahead of the similar period in previous years. The country trade has been especially good, Mr. Mainer declared, while that of the city has been normal. The Christmas business not only exceeds that of last year but is as good as in 1913, the year of the last great crop. The fact that this year western Canada has had a crop placed by the authorities at almost $500,000,000 has stimulated the electrical trade throughout the West.

Danish Concern Seeking Electrical Supplies in This Country.—B. Nordrup and H. Hoffman, representatives of Aage Havemann's Eftf., Copenhagen, Denmark, dealer and jobber in electrical supplies, have recently arrived in the United States and are in the market for various types of wiring devices, telephone accessories, annunciators, etc. The above-named concern is sole agent in Denmark for Mix & Genest, Berlin, and for lamps made by the Siemens-Schuckert Company. Mr. Nordrup, who is manager for the company mentioned above, has established temporary headquarters at 53 West Forty-seventh Street, New York. Mr. Nordrup states that his company is prepared to give orders for low-priced electrical supplies in large amounts for Russian establishments. On account of the fact that no brass or copper in any form can be shipped out of Germany in large amounts, it is impossible, Mr. Nordrup says, for his concern to get the electrical supplies containing parts of brass or copper which before the war were coming from that country.

The Electric Steel Company, Chicago, Ill., which has just been formed, will operate a Snyder Electric furnace and will confine itself to the turning out of small castings, especially of alloy steel. The officers of the concern are Charles Piez, president, and P. L. Coonley, secretary and treasurer, who are respectively president and vice-president of the Link-Belt Company, at whose Thirty-ninth Street plant in Chicago they have been in charge of a Zanzes steel converter for a number of years. The active management of the new company will be in the hands of John M. Olmsted, who will act as vice-president and who has been a member of the sales force of the Link-Belt Company. The board of directors will consist of Messrs. Piez, Coonley and Olmsted, and W. C. Frye and C. R. Messinger of Milwaukee. Mr. Frye is the financial head of the Sivyer Steel Casting Company, the Federal Malleable Company and other corporations of Milwaukee, while Mr. Messinger is vice-president and in active control of the Sivyer Steel Casting Company. Although the company will not be able to deliver castings before Feb. 15, a large proportion of its output is already contracted for. The company has leased the plant at Thirty-first Street and Wood Street, Chicago, formerly occupied by the Wildman Boiler Works. Power for the plant will be obtained from the Commonwealth Edison Company.

NEW YORK METAL MARKET PRICES

	Dec. 21 Selling Prices Bid	Dec. 21 Selling Prices Asked	Dec. 28 Selling Prices Bid	Dec. 28 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	84 5 0		85 15 0	
Prime Lake	20.12½	to 20.37½	21.75	to 22.00†
Electrolytic	20.12½	to 20.37½	21.75	to 22.00†
Casting	19.50	to 19.75	20.87½	to 21.12½†
Copper wire base	21.12½	to 21.37½†	22.75	to 23.25†
Lead	5.40		5.40	
Nickel	45.00	to 50.00	45.00	to 50.00
Sheet zinc, f.o.b. smelter	22.00†		22.00†	
Spelter, spot	17.55	to 17.80	17.42½	to 17.67½
Tin, Straits	39.62½†		39.12½	
Aluminum, 98 to 99 per cent.	51.00	to 53.00	53.00	to 55.00

OLD METALS

Heavy copper and wire	16.00	to 16.50†	17.00	to 17.50†
Brass, heavy	11.00	to 11.25†	11.50	to 12.00†
Brass, light	9.00	to 9.25†	9.25	to 9.75†
Lead, heavy	4.75	to 4.87½†	4.75	to 4.87½†
Zinc, scrap	11.00	to 12.00†	12.50	to 13.00†

COPPER EXPORTS

Total tons to Dec. 28 26,382

†Nominal.

Corporate and Financial

American Gas Company, Philadelphia, Pa.—An issue of $1,000,000 of one-hundred-year 6 per cent gold bonds, due Jan. 1, 2016, has been sold at 99.5 and interest.

Crawford County Gas & Electric Company, Crestline, Ohio.—The Cleveland, Southwestern & Columbus Railway Company has made arrangements to purchase the property and business of the Crawford County Gas & Electric Company, and joint application has been made to the Ohio Public Utilities Commission for permission to close negotiations.

Duquesne Light Company, Pittsburgh, Pa.—A plan has been announced for the sale of preferred stock of the company to employees. Each employee will be entitled to subscribe for $100 of 7 per cent cumulative preferred stock for every $100 of his salary for 1915. Monthly payments of $1.25 per share are to be made, and the employee subscribing will be credited with dividends at 7 per cent and charged at the rate of 5 per cent each year on the unpaid balance of his subscription. If he has made regular payments over a period of five years he will receive a bonus of $5 for each share from the company and his proportion of a fund that may accumulate from the aggregate of $5 per share on stock that has been canceled before termination of the arrangement.

General Gas & Electric Company, New York, N. Y.—The directors of the company have declared a regular quarterly dividend of 1.75 per cent on the cumulative preferred stock, payable Jan. 3, 1916, to stock of record Dec. 22. They have also declared an accumulated dividend of 0.5 per cent on stock outstanding Sept. 30, 1914, and 0.25 per cent on stock outstanding Sept. 30, 1915. The General Gas & Electric Company was organized in July, 1912. The stock was a cumulative 6 per cent stock until July 1, 1915, when it became a cumulative 7 per cent stock. The dividends just declared pay up all past accumulations and place the stock on a regular 7 per cent basis. The company reports combined gross earnings of its subsidiaries for November of $231,195, an increase of 11.4 per cent over 1914, and for eleven months ended Nov. 30 of $2,178,564, or 9.1 per cent over the same months in 1914. The outlook is for a still greater percentage of increase during 1916, as there are a large number of power users in the various territories served not yet supplied by electricity, many of whom are now making arrangements for electric operation. The following figures show the proportion of gross earnings which was derived from electric light and power, gas and electric railways for the ten months ended Oct. 31, 1915: Electric light and power, 66.2 per cent; gas, 19.9 per cent; electric railways, 13.9 per cent. A preliminary forecast of 1915 results (December estimated), made by the managers, W. S. Barstow & Company, shows earnings applicable to dividends on cumulative preferred stock of the company to be in excess of one and a half times dividend requirements for the year. The managers report that a much greater percentage of earnings has been spent for maintenance than during the previous year and that the properties are in excellent physical condition. The Sandusky Gas & Electric Company, one of the subsidiaries, has recently completed arrangements for the sale of $750,000 bonds to refund an issue previously outstanding and provide for construction expenditures in connection with the new street-lighting system now being installed.

Great Shoshone & Twin Falls (Idaho) Water Power Company.—Van W. Hasbrouck, special master of the United States District Court, on Jan. 8, 1916, will sell all of the lands, power plants, power sites, transmission lines and other property owned by the Great Shoshone & Twin Falls Water Power Company. This sale is made under foreclosure and receivership proceedings, and it is understood will be followed by the absorption of the Great Shoshone company by the Electric Investment Company, which has taken over most of the power companies in southern Idaho.

Great Western Power Company of California, San Francisco, Cal.—An issue of $4,500,000 of ten-year 6 per cent convertible gold debenture bonds, due Nov. 1, 1925, is being offered at 96.5 and interest to yield about 6.5 per cent. These debentures are convertible from Nov. 1, 1917, to Nov. 1, 1920, at par and accrued interest into 7 per cent preferred stock of the company at $95 per share and accrued dividends. Of the preferred stock into which these debentures are convertible there is at present none outstanding, and with the exception of that amount which is reserved against conversion, none may be issued without the approval of the California commission and unless the surplus after fixed charges is at least twice the preferred-stock dividend requirements. The earnings of the system for the twelve months ended Sept. 30, 1915, were as follows:

	1915	1914
Gross earnings	$2,830,821	$2,684,042
Operating expenses and taxes	833,995	950,790
Net earnings	$1,996,826	$1,733,252
Other income, including interest charged to capital	195,329	230,282
Total income	$2,192,155	$1,963,534
Bond interest and dividends on guaranteed stock	1,332,450	.....
Surplus after bond interest	$859,705	.....
Interest on debentures	270,000	.....
Final surplus	$589,705	.....

Mountain Light & Water Company, California.—The California Railroad Commission has authorized the Brookdale Land Company to sell its electric light and water plant to the Mountain Light & Water Company, Santa Cruz County. The purchaser is authorized to issue $23,500 bonds and $25,000 stock.

Official Statement of Rules for British Mobilization of American Securities.—The official statement issued for the committee of the London Stock Exchange in regard to the sale of securities of the United States owned by British subjects is in full as follows: "The Lords Commissioners of His Majesty's Treasury have agreed that the committee for general purposes should have power to allow transactions for sale in North America of securities which have been in physical possession in allied or neutral countries since the outbreak of war, subject to the committee being satisfied in each case that the sale is an agency transaction between the allied or neutral country and North America, that it is to be carried out through a member of the stock exchange, and subject to satisfactory assurances being obtained that the selling order is not on behalf of or for the benefit of the enemy either directly or indirectly. Their lordships have further approved the proposal that in such cases the usual green form should not be attached to the bond or certificate, but that in each case the committee should be informed of the name of the member through whom the sale had been transacted and that special permission should be given to each of the members concerned to complete the transaction without the green form. Brokers wishing to avail themselves of this provision should apply by letter to the sub-committee for the administration of Temporary Regulation No. 10 at the share and loan department, 26 Austin Friars. They will be required to satisfy the sub-committee that the sale is an agency transaction between the allied or neutral country and North America, that it is to be carried out through a member of the stock exchange, and that the selling order is not on behalf of or for the benefit of the enemy either directly or indirectly. If the sale is authorized by the sub-committee, the broker will forward the name of the member through whom the sale has been transacted to the secretary to the committee for general purposes, who will issue the necessary permit for the completion of the transaction without the green form."

Utah Power & Light Company, Salt Lake City, Utah.—The Electric Bond & Share Company is offering an allotment of the 7 per cent cumulative preferred stock of the Utah Power & Light Company to intermountain investors through Salt Lake City bankers. The outstanding shares of this stock, amounting to $3,000,000, were recently purchased by the Electric Bond & Share Company from the Utah Securities Corporation. This is the first time, it is stated, that any of the securities of the Utah Power & Light Company except bonds have been offered locally to the company's patrons.

Wagner Electric Manufacturing Company, St. Louis, Mo.—Announcement has been made of an extra cash dividend of 2 per cent in addition to the regular quarterly dividend of 2 per cent and a stock dividend of 10 per cent to be paid to stockholders on Jan. 1.

New Utility and Industrial Companies

The Union Light & Power Company of Augusta, Me., has been incorporated with a capital stock of $50,000 by Ernest L. McLean, Frank E. Southard and others.

The Detroit Safety Signal Company of Detroit, Mich., has been incorporated with a capital stock of $12,000 by H. C. Dolan, Malcolm J. McLeod, Clement Althoff and Laura C. Moore.

The Disco Electric Starter Company of Detroit, Mich., has filed articles of incorporation with a capital stock of $250,000. The incorporators are S. Meyer, Sydney W. Elston and Howard Streeter.

The Southern Wisconsin Electric Company of Lake Geneva, Wis., has been incorporated with a capital stock of $100,000. The incorporators are John B. Sanborn, Chauncey E. Blake and J. P. Alberg of Lake Geneva.

The Woodruff Electric Light & Power Company of Bismarck, N. D., has filed articles of incorporation with a capital stock of $25,000. The incorporators are W. G. and E. E. Woodruff and G. F. Dullam of Bismarck.

The Richmond Electric Company of Richmond, Ill., has been incorporated with a capital stock of $1,000 to generate and distribute electricity in Richmond. The incorporators are Leslie Latimer, M. Murphy and P. L. Miller.

Brown & Ross, Inc., of Springfield, Mass., have filed articles of incorporation with a capital stock of $25,000 for the purpose of manufacturing electrical apparatus. The incorporators are George B. Brown, Alexander N. Ross and Laura N. Brown.

The Alamo Light Plant Company of Omaha, Neb., has been incorporated by Bert Le Bron, F. L. Tubbs of Omaha and George E. Tubbs of Hillsdale, Mich. The company is capitalized at $100,000 and intends to manufacture and sell electric-lighting plants for farms.

The Electric Stethoscope Company of New York, N. Y., has been incorporated with a capital stock of $250,000 to manufacture stethoscopes, detectors, surgical instruments, etc. The incorporators are S. B. Wellington, J. C. Gordon and E. R. Dodge, 154 Nassau Street, New York, N. Y.

The Tamms Ice, Light & Fuel Company of Tamms, Ill., has been incorporated by E. J. Hodges, Sr., E. J. Hodges, Jr., and Mildred Hodges. The company is capitalized at $2,500 and intends to generate and distribute electricity in Tamms and to manufacture and supply ice for the general public.

The Simplex Magnet Company of Millbrook, N. Y., has been incorporated with a capital stock of $50,000 by Charles Messerschmidt and Leo L. Lowry, 317 West Ninety-third Street, New York, N. Y. The company intends to manufacture and deal in magnetos, internal-combustion auto parts, etc.

The Red Top Electric Company of New York, N. Y., has filed articles of incorporation with a capital stock of $500,000 for the purpose of manufacturing electric toasters, stoves, heaters and other appliances. The incorporators are H. J. Lucke, I. E. A. Konigsberg and S. H. Dader, 2 Rector Street, New York, N. Y.

The Elevator Efficiency Appliance Company of Albany, N. Y., has been incorporated with a capital stock of $100,000 by Charles O. Mark and Samuel Bruckheimer, 1058 Madison Avenue, Albany, N. Y. The company purposes to manufacture engines, dynamos, doors, hangers, structural iron, steel, etc.

The Pocock Safety Lamp Company of New York, N. Y., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 for the purpose of manufacturing and dealing in electric safety lamps, etc. The incorporators are Herbert E. Latter, Norman P. Coffin and Clement N. Egner, all of Wilmington, Del.

The Pouvailsmith Corporation of Poughkeepsie, N. Y., has filed articles of incorporation with a capital stock of $2,500,000. The company will manufacture appliances for autos, steering wheels, autos, electric and other motors, etc. The incorporators are G. E. Smith, 18 Hooker Avenue; J. W. Poucher, 339 Mill Street, and E. C. Vail, 8 South Hamilton Street, Poughkeepsie, N. Y.

Trade Publications

Electric Washer.—The Vacuum Washer Company, Ripon, Wis., is sending out an illustrated folder on its vacuum-type washing machine.

Suspension Insulators.—The R. Thomas & Sons Company, East Liverpool, Ohio, is sending out a folder descriptive of its No. 1141 suspension insulator.

Vulcanizers.—The Lazarus Manufacturing Company, 746 Euclid Avenue, Cleveland, Ohio, has prepared an illustrated folder on its electric vulcanizers.

Portable Vacuum Cleaners.—The Regina Company, 47 West Thirty-fourth Street, New York, is sending out several illustrated folders on its portable vacuum cleaners.

Splicing Links and Insulators.—Thomas M. Harrigan, Woodstock, Vt., is sending out a loose-leaf calendar which contains information on splicing links and insulators.

Boiler Compound.—The Standard Chemical Company, Kalamazoo, Mich., has issued a booklet descriptive of its "Protecto," a substance for removing scale from boilers.

Tandem Boxes for Exposed Work.—The Fancleve Specialty Company, Jamaica Plain, Mass., is sending out a leaflet descriptive of its new tandem boxes for exposed work.

Ornamental Lighting Fixtures.—Shapiro & Aronson, 20 Warren Street, New York, have issued an attractive booklet which lists a number of different types of ornamental lighting fixtures.

Steel-Inclosed Switches.—The Detroit Fuse & Manufacing Company, Detroit, Mich., is sending out illustrated folders on its "Square D" steel-inclosed switches for industrial safety.

Cross-Over Protecting Clamps.—Hickey & Schneider, 61 Broadway, New York, are sending out an illustrated loose-leaf catalog on cross-over protecting clamps, splicing sleeves and transmission-line clamps.

Oil Engines.—The De La Vergne Machine Company, 1186 East 138th Street, New York, has prepared an attractively illustrated large-sized calendar which shows several types and actual installations of its oil engines.

Motor-Driven Sirens.—The Federal Sign System (Electric), Lake and Desplaines Streets, Chicago, Ill., is sending out descriptive leaflets on its direct-current and alternating-current sirens for outdoor and indoor service.

Demand Indicators.—The Fort Wayne Electric Works of the General Electric Company, Fort Wayne, Ind., is sending out Bulletin No. 46,102, on Type H demand indicators, and Bulletin No. 46,103, on Type M-2 demand indicators.

Canteen-Shaped Sign.—The Solar Electric Company, 154 West Lake Street, Chicago, Ill., is sending out a number of illustrated bulletins containing information on and illustrations of its various types of canteen-shaped electrically illuminated signs.

High-Tension Equipment.—The Delta-Star Electric Company, Chicago, Ill., is distributing Descriptive Leaflet No. 910, which shows special high-tension disconnecting switches, "Unit-Type" indoor equipment, suspension-type disconnecting switches and surge arresters.

Electric Power Development.—"Notes on Electric Power Development" is the title of a paper presented at the meeting of the Railway Club of Pittsburgh by E. M. Herr, reprints of which are being sent out by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Electric Pressure and Suction Blowers for Organs and Mechanical Orchestras.—The Kinetic Engineering Company, Philadelphia, Pa., has issued several illustrated catalogs on its electrically operated blowers for organs and combination suction and pressure blowers for mechanical orchestras.

Poles and Cross-Arms.—The Southern Exchange Company, 97 Warren Street, New York, has issued an attractive and interesting booklet which contains information on the felling of trees used for lighting poles and considerable data on poles of Southern white cedar, long-leaf yellow pine, cypress and chestnut, and on cross-arms of long-leaf Georgia pine.

New England

TURNER, ME.—The Turner Lt. & Pwr. Co. has applied to the Public Utilities Commission for permission to issue $25,000 in bonds.

HULL, MASS.—At a special town meeting held Dec. 23 it was voted to abandon the municipal generating plant and to purchase electricity from a private company. The Board of Selectmen was authorized to make a contract (not exceeding ten years) with an electric company, probably the Weymouth El. Lt. & Pwr. Co., to supply energy to operate the municipal system. The distribution system supplies Nantasket Beach, Pemberton Peninsula, and includes a summer-cottage district which is one of the most densely settled in the vicinity of Boston.

GROTON, CONN.—Plans are being discussed for enlarging the municipal electric-lighting plant in Groton.

WINSTED, CONN.—Plans are being prepared, it is reported, for the construction of a hydroelectric power plant for the Winsted Gas Co., to cost approximately $100,000.

Middle Atlantic

CANAJOHARIE, N. Y.—The Public Service Commission has authorized the Montgomery County El. Lt. & Pwr. Co., Canajoharie, to extend its transmission lines into the towns of Sharon and Cherry Valley and the village of Cherry Valley. The company is also authorized to issue $15,000 in capital stock, the proceeds to be used for new extensions as follows: Transmission line from Sharon Springs to Cherry Valley, 6½ miles, $6,000; substation in Cherry Valley, $2,439, and the distribution system, $4,372; installation of street-lighting system, consisting of 44 lamps, $315.

HORNELL, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 19, 1916, for construction complete, including mechanical equipment and approaches, of the United States post office at Hornell, N. Y.

SANBORN, N. Y.—The Sanborn-Pekin Pwr. Co., recently incorporated with a capital stock of $10,000, proposes to supply electricity for lamps and motors in towns and villages in Niagara County, including Sanborn, Lewiston, Pekin, Cambria, North Ridge, Wilson, Bergholtz and Wheatfield. The directors are Henry B. Treichler, Jr., J. B. Hudson, B. L. Hudson, A. W. Schoelles, F. R. Stover, G. H. Stover and Ralph E. Casselman.

WEST POINT, N. Y.—Bids will be received at the office of the quartermaster, West Point, until Jan. 24, for two water-tube boilers and stokers. Further information on application.

ALLENTOWN, PA.—The Traylor Engineering & Manufacturing Co. is contemplating the erection of new buildings, including a large machine shop and a four-story warehouse, involving an expenditure of about $300,000. All new machinery, it is understood, will be electrically driven, to conform with the rest of the plant. Samuel W. Traylor is president.

MEADVILLE, PA.—Plans are being considered for extensions and improvements to the municipal electric-light plant, involving an expenditure of about $10,000.

PHILADELPHIA, PA. — Arrangements are being made to erect a power house and factory, to cost about $300,000, at Westmoreland Street and Frankford Avenue for Thomas Wolstenholme, Sons & Co. W. E. S. Dyer, Land Title Building, Philadelphia, is engineer in charge.

READING, PA.—The Reading Transit & Lt. Co., it is reported, is considering plans for improvements to its power plant in West Reading, to cost about $300,000.

WEST MIDDLESEX, PA.—The West Middlesex El. Lt. & Pwr. Co., represented by Dr. J. A. Hunter and J. R. Haudenshield, has petitioned the Borough Council for a franchise to install and operate an electric-lighting plant in West Middlesex.

CAMDEN, N. J.—The Public Ser. El. Co. will soon submit to the City Council a proposal for extension of the new arc-lamp lighting system on a number of streets in the business section of the city.

IRVINGTON, N. J.—The Town Commission is considering plans for the installation of a municipal electric-lighting plant and water-works system in Irvington.

NEWARK, N. J.—A power plant, it is reported, will be installed in the new bottling plant to be erected by Seiler Brothers, Inc., on Waverly Avenue.

WINDSOR (not a post office), W. VA.—The American Gas & El. Co., 30 Church Street, New York, through one of its subsidiary organizations has started construction of a steam-power electric plant at Windsor on the West Virginia shore of the Ohio River. The coal supply of the plant will be derived from a mine the tipple of which will discharge coal directly at the plant. The initial equipment will consist of nine 1250-hp. water-tube boilers equipped with automatic stokers, superheaters and economizers, the induced-draft system being used. The coal and the ash-handling equipment will be electrically operated; auxiliaries will all be motor driven. The plant is designed for the ultimate installation of six 30,000-kw. turbines, but the initial equipment as at present planned will consist of two 30,000-kw. General Electric (Curtis type) turbines. For arrangement of the condensing equipment the engineers propose to take advantage of the elevation of the plant above the Ohio River by excavating condenser wells, which will be completely inclosed in concrete caissons, and the construction of intake and discharge tunnels of approximately 30 ft. in diameter, whereby water from the river will be diverted to flow through the condensers, thus obviating the necessity of pumping large quantities of condensing water against a considerable head. The transmission line between the generating plant and Canton will consist of a steel-tower line carrying double circuits operated at 132,000 volts. Extensions of this line and other lines in different directions are now being planned by the company. The purpose of this plant is primarily to supply energy to the Wheeling El. Co. and the Canton El. Co. and later to the Ohio Lt. & Pwr. Co., all of these being affiliated with the American Gas & El. Co.; also to other public utilities and to large continuous users of power such as steel mills and other similar industries situated in the district between Pittsburgh and Youngstown, Canton and Wheeling. The cost of the initial development is estimated at $2,500,000. In the issue of Dec. 18, under Wellsburg, W. Va., further information will be found regarding this plant. Sargent & Lundy, consulting engineers, Railway Exchange Building, Chicago, Ill., are designing engineers, but the construction will be carried out under the joint supervision of the designing engineers and the engineering department of the American Gas & Electric Co.

ALEXANDRIA, VA.—The City Point Ice Corpn., Alexandria, is contemplating the purchase of an electric generating unit, consisting of a 35-kw., 125-volt or 250-volt direct-current generator, directly connected to steam engine; 72-in. by 18-in. horizontal return-tubular boilers, to carry not less than 110 lb. steam pressure (Heine water-tube type is under consideration); steam condenser for 50-ton ice plant, Zeigler vertical preferred; 35-hp. automatic steam engine; self-supporting stack, 54 in. or 60 in. in diameter, about 125 ft. high.

FREDERICKSBURG, VA.—The Southern Gravel Co., it is reported, has awarded a contract to the Rappahannock El. Lt. & Pwr. Co., Fredericksburg, to install an electric-lighting system at its gravel mines, 4 miles from Fredericksburg.

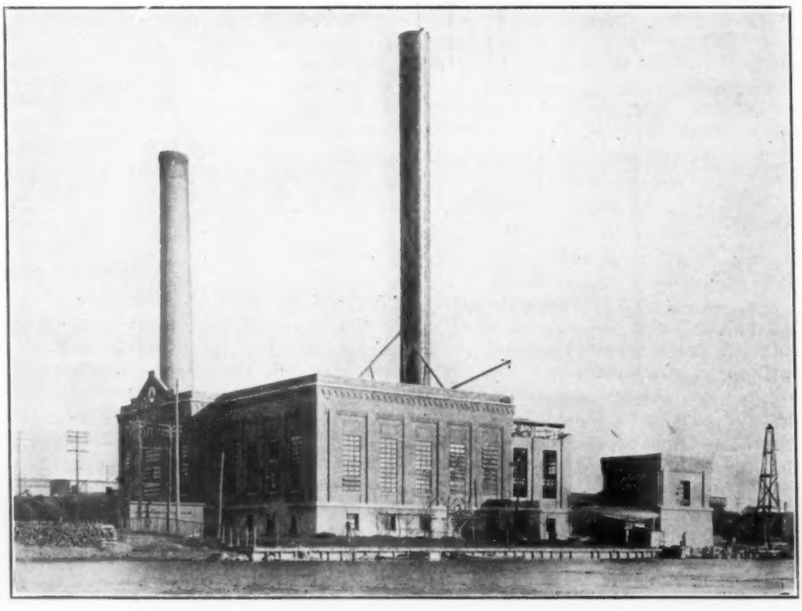
WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations the following supplies: Newport, R. I., Schedule 9160—400,000 lb. unannealed brass tubes. Brooklyn, N. Y., Schedule 9153—11,000 solid and cored arc-lamp carbons, 18,200 ft. single-conductor wire; Schedule 9151—140,000 ft. incandescent lamp cord; Schedule 9158—54 electric portable drills. Pensacola, Fla., Schedule 9146—miscellaneous sheet brass and miscellaneous cold-rolled sheet copper. Boston, Mass., Schedule 9153—miscellaneous hot-rolled sheet copper.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

The Riverside Steam Turbine Station of the Minneapolis General Electric Company

Extensive improvements are being made to the Riverside steam turbine station of the Minneapolis General Electric Company. The turbine room is now being enlarged, as shown in the accompanying illustration, to provide space for a new 15,000-kw. electric generating unit. New equipment, including condensing apparatus, boilers, etc., will also be installed, and extensions will be made to the coal-handling apparatus. A new steel stack has been built to take care of the increased boiler capacity. The small building at the right is known as the screen house and was erected for the purpose of operating the screens in the new intake from the river, protection of the apparatus being necessary owing to the extremely cold winters in this section. The original power house, which has a rating of 12,000 kw., was built in 1911, in practically 150 days, by the Stone & Webster Engineering Corporation of Boston, Mass. The main generating station of the Minneapolis company was previously destroyed by fire on Jan. 6, 1911. Ground was broken for the new power house on Feb. 25 and electric energy was produced Aug. 1, 1911. At the same time the Stone & Webster Corporation also built a large distributing station on the site of the old Main Street station and a substation on Sixth Street, with several miles of underground transmission line. The distributing station receives the output not only of the steam station but also of the Taylor's Falls hydroelectric plant. The Minneapolis General Electric Company is now owned and operated by H. M. Byllesby & Co. of Chicago, Ill., and the latter's engineers have had charge of the new extensions to the Riverside steam plant.



WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 19,436—The commercial attaché of the Department of Commerce in England writes that a firm in that country desires to be placed in direct communication with manufacturers of wood knobs and steel-coppered wire. The wire should be 13-gage standard, and knobs are to be drilled to a depth of ¼ in., so that the wire will slide easily without play. Samples of the articles may be examined at the bureau or its branch offices. (Refer to file No. 914.) No. 19,464—An American consular officer in Portugal reports that there is a demand for immediate delivery of copper amounting to about 12,000,000 lb., percentage of mineral to be about 98 per cent. Prices and terms on 100 tons should be quoted by cable. No. 19,512—An American consular officer reports that a firm in France desires to be placed in communication with manufacturers of electrical supplies and lamp shades made of metal and porcelain. Correspondence should be in French. No. 19,525—A report from an American consular officer in Ecuador states that a new telephone system is to be installed in one of the large cities of that country. Specifiations and full information may be obtained from the bureau or its branches. (Refer to file No. 69,511.) No. 19,562—A Portuguese firm informs an American consular officer that it is anxious to get in touch with exporters of copper and brass in sheets, tubes and bars. Quotations should be c. i. f. port of destination and correspondence in Portuguese or French. No. 19,595—A commercial organization informs the bureau that a business man in Spain desires to correspond with manufacturers of galvanized-steel cables, manila cables and ropes for fishing nets. No. 19,605—A firm in the United States writes that a firm in Spain desires to obtain exclusive agencies for American electrical goods and hardware. No. 19,609—A commercial organization in the United States writes that the manager of a large firm in Peru desires to communicate with manufacturers of electric elevators, electric installation for cities; also electrical material, such as copper wire and insulators for installations. Catalogs, quotations, terms, etc., are desired. No. 19,615—An American consular officer in the Far East reports that a company in his district desires to import seamless steel tubing of all kinds and tungsten filament in large quantities. No. 19,626—A manufacturer's agent informs an American consular officer that he desires to act as agent, on a commission basis, for manufacturers of real and imitation jewelry, gas and electric lighting apparatus, photographic accessories, etc. No. 19,628—A report from an American consular officer states that a man in Spain desires to act as agent for firms manufacturing electrical goods, such as electric bulbs of 0.5 watt from 50 cp. to 500 cp. for voltages of 110 and 220. The inquirer, it is stated, can sell from 8000 to 10,000 per month. Prices and terms are also requested for metal-filament bulbs from 10 cp. to 50 cp., for which there is a sale of about 25,000 per month. An agency is also desired for electrically driven pumps and apparatus. Catalogs and correspondence should be in Spanish, but prices, if possible, should be in francs. Further information may be obtained on application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branch offices.

North Central

DETROIT, MICH.—Contract for the 15-story addition to the Hotel Statler (to contain 250 rooms) has been awarded to the F. W. Mark Construction Co., Cleveland, Ohio.

IRON RIVER, MICH.—The Cleveland Cliffs Iron Co. has awarded the contract for the construction of its buildings on the Speis lands at Iron River to J. S. Wahlman, Ishpeming. The contract includes a power house (28 ft. by 44 ft.), a boiler house (36 ft. by 50 ft.), shop building, dry office, ten single dwellings and a boarding house. All the buildings will be of frame construction.

CANAL FULTON, OHIO.—The Village Council has granted the Massillon (Ohio) Gas & El. Co. a franchise to construct and operate an electric light and power plant in Canal Fulton.

CINCINNATI, OHIO.—Plans have been prepared by John Boll, architect, Bodman Building, Cincinnati, for the construction of a 16-story concrete power building at North Street and Broadway, to cost about $300,000.

CINCINNATI, OHIO.—The Standard Engineering Co. has sublet to the Triumph El. Co., Cincinnati, the contract for the installation of an ice and refrigerating system in the new Hamilton County Court House, now under construction.

HAMILTON, OHIO—The County Commissioners have granted the Hamilton Utilities Co. a 10-year franchise to erect an overhead transmission line along the pike from Overpeck to Trenton.

TOLEDO, OHIO.—An ordinance has been prepared authorizing the Board of Park Commissioners to purchase the necessary equipment for lighting the parks and boulevards with electric lamps.

CARLISLE, KY.—Arrangements have been made by the Carlisle El. Lt. & Pwr. Co. for the erection of a 20-ton ice factory, to be operated in connection with tile plant. M. V. Bostain is manager.

COLUMBIA, KY.—The Columbia Ltg. Co. will soon install a 50-hp. crude-oil engine.

CYNTHIANA, KY.—The Kentucky Utilities Co., Lexington, which recently took over the property of the Cynthiana El. Lt. Co., is contemplating the installation of additional generating equipment and establishing a 24-hour service.

DIXON, KY.—The City Council has made arrangements with the Clay (Ky.) Lt. & Ice Co. for furnishing electrical service (24 hours) in Dixon. The company will erect a transmission line, 8 miles long, from Clay to Dixon, and will also supply electricity to the farmers along the line.

GEORGETOWN, KY.—The construction of an electric-light plant and waterworks system is under consideration by the City Council. A site on Elkhorn Creek, it is understood, has been purchased.

MOUNT OLIVET, KY.—The contract for the proposed electric-light plant for the Mount Olivet Lt. & Pwr. Co. will be awarded in the near future. Oil engines will be used for motive power. W. S. Chandler is interested in the company.

COLUMBUS, IND.—The city of Columbus is contemplating the installation of a 375-kva. electric generating unit in the municipal electric-light plant the first of the year. J. C. Rush is manager.

GOSHEN, IND.—The capital stock of the Hawks El. Co., Goshen, has been increased from $155,000 to $200,000.

MILLER, IND.—The town of Miller is building a water-works system instead of an electrical plant. Reported in the issue of Dec. 11 that the town had applied to the Public Service Commission for permission to issue $12,500 in bonds for the construction of a new municipal electric-light plant. The municipal electric-light plant was built in 1910. Carl Olander is town clerk.

AURORA, ILL.—The finance committee has asked the Council to authorize an appropriation of $11,000 to purchase new machinery for the pumping and power station north of the city.

SPRINGFIELD, ILL.—An ordinance has been completed by City Engineer Wade providing for the proposed ornamental lighting system in Monroe Street from Spring to Tenth Street, and in Washington Street from First to Tenth Street, to cost approximately $15,000.

JANESVILLE, WIS.—Bids will be received at the office of the Board of Public Works, Janesville, until Jan. 11 for furnishing f.o.b. Janesville 125 to 135 lamp standards for the proposed lighting system. Bids to be submitted as follows: (1) For each standard complete with post and lamp unit; (2) each standard complete without lamp unit; (3) each lamp unit complete without standard; (4) each lamp unit complete without standard and compensator. Plans and specifications are on file in the above office.

MONTICELLO, WIS.—Bonds to the amount of $12,000 have been voted for improvements to the municipal electric-lighting system.

ALEXANDRIA, MINN.—Bids will be received until Jan. 5 for central-office equipment and subscribers' station instruments, and to make definite arrangements for rebuilding all telephone lines in the city.

HALLOCK, MINN.—Bonds have been voted by the towns of Greenbush and Hallock for the construction of a municipal electric-light plant.

VIRGINA, MINN.—Plans are being considered, it is reported, for extending the electric-lighting system to Parkville.

WADENA, MINN.—The Otter Tail Pwr. Co., Fergus Falls, is reported to be contemplating extending its transmission lines to Wadena.

CUMBERLAND, IOWA.—The installation of a municipal electric-lighting plant in Cumberland is under consideration.

MANNING, IOWA—The Manning El. Lt. Co. expects to install in March or April one 150-kw., 250-volt direct-current generator, switchboard equipment, etc. A. J. Rushenberg is secretary and manager.

VINTON, IOWA—The town of Vinton expects to install by April 1 or May 1 two 300-kva. steam turbines, new switchboard and new pumps for water-works system, which is operated in connection with the lighting plant. W. E. Klingman is superintendent.

WATERLOO, IOWA.—The installation of ornamental lamps on Sycamore Street from East Park Avenue to East Third Street, and on East Park Avenue from Lafayette to Sycamore Street, is reported to be under consideration.

WATERLOO, IOWA.—The Citizens' Gas & El. Co., Waterloo, has submitted a proposal to the City Council asking for a new franchise for a period of twenty-five years and nullifying the present franchise, which expires in ten years. The company proposes to erect a large electrical power station, to cost between $700,000 and $800,000, making Waterloo a center for generating and distributing electricity to cities and rural communities. Austin Burt is manager.

CARROLLTON, MO.—The Wtr., Lt. & Transit Co., Carrollton, has secured franchises in Bogard and Bosworth and is erecting a transmission line (13,200 volts, three-phase) to supply the two towns. The company has also applied for a franchise in the town of Tina. The street-lighting system in Bosworth consists of 30 incandescent lamps of 60 cp., and in Bogard of 15 lamps of 60 cp. H. W. Graham is manager.

MAPLEWOOD, MO.—The residents of Maplewood have voted to grant the Western Pwr. & Lt. Co., a subsidiary of the Light & Development Co., St. Louis, a ten-year franchise and a ten-year street-lighting contract. The new contract provides for 200 street lamps of 60 cp.

ENDERLIN, N. D.—Frank C. Corson & Co., it is reported, have been granted a franchise to install an electric-light plant in Enderlin.

MILBANK, S. D.—Bids will be received by the Board of County Commissioners of Grant County, Milbank, S. D., until Jan. 12 for furnishing and installing electric fixtures, vault doors, vacuum cleaner, all wood and metal furniture, etc., for the county court house at Milbank. Plans and specifications can be seen at the office of E. M. Harper, county auditor, Milbank, and at the office of Bell & Bentley, architects, Security Building, Minneapolis, Minn.

CORTLAND, NEB.—A. J. Goodban, it is reported, is contemplating the installation of an electric-light plant in Cortland.

VALLEY, NEB.—The municipal electric plant has been leased by the Central Station Engineering Co., City National Bank Building, Omaha, which contemplates improvements to the plant and service, including the installation of a new generator and boiler; also a new street-lighting system consisting of 42 series tungsten lamps of 80 cp.

BURLINGAME, KAN.—The City Council, it is reported, is contemplating improvements to the municipal electric-light plant.

COFFEYVILLE, KAN.—All bids submitted for additions to and remodeling the municipal electric-light plant, it is reported, have been rejected. New bids will be called for later. Earl Cathers is city engineer.

DWIGHT, KAN.—The R. B. Fegan Co., Junction City, Kan., has been granted a franchise to install an electric-light plant in Dwight.

ESKRIDGE, KAN.—The installation of a municipal electric-light plant in Eskridge is under consideration.

PAOLA, KAN.—The Council has awarded the People's El. Lt. Co. a contract for lighting the streets of the city for a period of nine years. The proposal to establish a municipal electric-light plant, it is said, has been abandoned. W. H. Moorehouse is president of the People's company.

PERRY, KAN.—The contract for new equipment for the municipal electric-light plant, consisting of a 35-kw., 125-volt direct-current four-pole generator directly connected to a 50-hp. semi-Diesel oil engine, has been awarded to Fairbanks, Morse & Co. F. W. Bettys is manager.

Southern States

GREENSBORO, N. C.—The Southern Pwr. Co., it is reported, contemplates the construction of an electric railway from Greensboro to Reidsville and Spray, a distance of about 30 miles. W. S. Lee, Charlotte, is chief engineer.

SHELBY, N. C.—Bids will be received

at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 26, 1916, for construction complete, including mechanical equipment and approaches, of the United States post office at Shelby, N. C.

DARLINGTON, S. C.—Bids will be received by the Darlington Brick & Tile Co. on new or second-hand machinery and equipment as follows: One 75-kva., 60-cycle, three-phase, 2300-volt General Electric generator; one 3-kw., 125-volt C. V. C., flat-compound-wound, direct-current generator; one panelboard, natural black slate, 48 in. by 20 in. by 1½ in., mounted on 76-in. pipe support, equipped with ammeters, switches, receptacle, rheostat mechanism, current transformers, synchroscope-lamp receptacle, voltmeter and potential-synchronizing plugs; one 50-hp., three-phase, 60-cycle, 2200-volt motor with controller; two 60-amp., 2500-volt automatic oil switches; one 10-hp., three-phase, 60-cycle, 550-volt motor with compensator (A-3); two 5-kva., 2200/608-volt oil-cooled transformers; one 35-hp., three-phase, 60-cycle, 2200-volt motor with controller. Second-hand machinery in good condition may be considered.

UNION, S. C.—Contracts have been awarded by the Municipal Electric Light and Water Works Department for an electric generating unit, consisting of a 312-kw. General Electric generator directly connected to a Harrisburg uniflow engine. R. A. Easterling is superintendent.

CHICKAMAUGA, GA.—The Crystal Spring Bleachery has submitted a proposal to the City Council offering to supply electricity for lighting the city. The installation of an ice plant is also under consideration.

DAYTONA, FLA.—The Daytona El. Lt. & Pwr. Co. will install additional equipment in the spring, increasing the output by an amount ranging from 400 hp. to 480 hp. Michael Sholtz is president and manager.

FORT MEADE, FLA.—Bonds to the amount of $33,000 have been sold, the proceeds to be used for the construction of a new electric-lighting plant, extension of sewerage system and municipal waterworks.

HEBER SPRINGS, FLA.—The Heber Springs Lt. Co. is negotiating for a contract for supplying electricity for operating the pumping station of a municipally owned water-works system. If the deal goes through, the company will change its system to three-phase, 60 cycles, and will install two directly connected generating units, one 120-kw. and one 60-kw., driven preferably by Corliss engines; one 125-hp. boiler, one pump, complete with switchboards, exciters, etc. The company expects to exchange its present equipment for the above. H. N. Case is manager.

TAMPA, FLA.—The Palma Ceia Golf Association is contemplating the installation of an electric-light plant in connection with land development. T. E. Bryan, president of the Tampa Auto and Golf Club, is interested in the project.

MARYVILLE, TENN.—The Aluminum Co. of America, Pittsburgh, it is reported, contemplates the construction of a power dam at Maryville in connection with a new plant.

ATMORE, ALA.—The W. M. Carney Mill Co., which operates the local electric-light plant, is contemplating the installation of a pump and 25-hp. motor to pump the water supply for the town of Atmore. Fred Sintes is superintendent of the electric department.

BIRMINGHAM, ALA.—Martin J. Lide, consulting engineer, Birmingham, it is reported, is contemplating the purchase of two directly connected 250-volt to 275-volt direct-current units, preferably 75 kw. each.

TUSCALOOSA, ALA.—The Birmingham-Tuscaloosa Ry. & Utilities Co., Tuscaloosa, has recently acquired the property of the Tuscaloosa Ice & Lt. Co. O. R. Carter is vice-president and treasurer.

OXFORD, MISS.—Bonds to the amount of $6,500, it is reported, will be issued for improvements to the municipal electric-light plant and water-works system.

DODD CITY, ARK.—The Bear Mining Co. would like to receive prices on electric-lighting equipment. T. H. Braley, Dodd City, is manager.

BARTLESVILLE, OKLA.—Surveys, it is reported, will soon be made for an interurban railway from Bartlesville to Pawhuska. The Illuminating Oil Co., Bartlesville, is reported interested in the project.

AUSTIN, TEX.—Guy Collett, Austin, has been appointed receiver of the City Water Pwr. Co. of Hartford, Conn., and Austin, including the dam and hydroelectric plant of the company on the Colorado River at Austin, for this city. Improvements to the development are necessary and will be carried out under the direction of Mr. Collett. The cost is estimated at $100,000.

SHERMAN, TEX.—The Texas Trac. Co., Dallas, it is reported, will rebuild the local substation, recently destroyed by fire.

Pacific States

BELLINGHAM, WASH. — The City Council has passed a resolution instructing the Puget Sound Trac., Lt. & Pwr. Co. to replace the arc lamps now in use with tungsten lamps throughout the city. The change will require about 450 tungsten lamps, which will be installed without cost to the city.

EVERETT, WASH.—Notice has been filed with the county auditor of Snohomish County by H. K. Owens, consulting engineer, Empire Building, Seattle, representing E. C. Money, Everett, appropriating 1200 cu. ft. per second of water on the north fork of the Skykomish River for the development of power. Work on the project is to be started within 180 days.

OKANOGAN, WASH.—The County Commissioners, it is reported, have granted the Okanogan Valley Pwr. Co., Brewster, a franchise to erect an electric transmission line over the public roads of Douglas County from Bridgeport to Mansfield. The company has a franchise to supply electrical service in both of these towns.

SPOKANE, WASH.—Application has been made to the City Council by Fred B. Grinnell for a 25-year franchise to supply steam or hot water for heating in the city of Spokane and electricity for lamps and motors. The ordinance provides for an investment of $100,000 within three years.

ASTORIA, ORE.—Preparations are being made by D. S. Ewart, Astoria, electrical engineer, for the installation of a small electric-light plant on James Jamieson's ranch, near Jewell.

EUGENE, ORE.—The City Council has ratified the purchase by the city of Eugene of the franchise and holdings of the Oregon Pwr. Co. within the city limits.

JUNCTION CITY, ORE.—The City Council has granted the Oregon Pwr. Co. a five-year franchise. Plans are being considered by the company for a redistribution of the street lamps, providing for replacing the 400-cp. lamps now in use with 600-cp. nitrogen-gas filled tungsten lamps.

BISHOP, CAL.—The Bishop Lt. & Pwr. Co. has applied to the State Railroad Commission for permission to issue a first mortgage covering its property in California, to secure funds to re-finance its business and for extensions and improvements to its system.

BROOKDALE, CAL.—The State Railroad Commission has authorized the Brookdale Land Co. to sell its electric light and water plant to the Mountain Lt. & Wtr. Co., Santa Cruz County. The Mountain company has been granted permission to issue $25,000 in bonds and $25,000 in capital stock.

BURBANK, CAL.—Improvements are contemplated to the munipical electric-light plant, including the installation of three 75-kva., or two 100-kva., 15,000/2200-volt, 50-cycle transformers, general transmission-line supplies and 2200/220/110-volt, 50-cycle, single-phase transformers. T. C. Miller is manager.

SAN FRANCISCO, CAL.—The Universal El. & Gas Co., San Francisco, is installing two 500-kw. Westinghouse motor-generator sets. A. K. Harford is manager.

WENDELL, IDAHO.—The City Council has entered into a tentative contract with the Great Shoshone & Twin Falls Wtr. Pwr. Co., Twin Falls, for the installation of a new lighting system in Wendell. The plans provide for the erection of 400-cp., 250-cp. and a small number of 100-cp. lamps. H. B. King, Twin Falls, is superintendent of the company.

FLORENCE, ARIZ.—The proposed contract between the State of Arizona, the town of Florence and the Salt River Valley Water Users' Association for electricity from the Roosevelt dam project has been approved by the United States Reclamation Service. Right-of-way across the Pima Indian Reservation is the only matter to be adjusted, after which an election will be called to vote on the proposal to issue bonds for installing an electric distributing system in Florence.

GLOBE, ARIZ.—Plans are being considered, it is reported, by the Arizona Commercial Co. for the construction of a power plant to cost about $50,000.

MIAMI, ARIZ.—At an election held recently bonds to the amount of $40,000 were voted for the installation of a municipal electric light and power plant.

PRESCOTT, ARIZ.—The construction of a large water-storage dam and hydroelectric plant on Burro Creek is under consideration by Col. E. P. Thayer, Indianapolis, Ind., and associates, and surveys are now being made.

FORT KEOGH (not a post office), MONT.—Bids will be received by the depot quartermaster, Fort Keogh, until Jan. 15 for furnishing and installing an electric-lighting system. Further information may be obtained upon application to the quartermaster.

POLSON, MONT.—The County Commissioners have granted the Mission Range Pwr. Co. a right-of-way from the mountains east of Polson to this city. The company is erecting a hydroelectric power plant here which will supply electricity in Polson and surrounding towns.

RENO, NEV.—Plans are being considered by the City Council for the installation of electroliers in the downtown district and the gradual extension of the system into the residential sections of the city.

CLOVIS, N. M.—The City Council, it is reported, has called a special election to vote on the proposal to issue $25,000 in bonds for extensions and improvements to the lighting, sewer and water systems.

ROSWELL, N. M.—The Roswell Gas & El. Co. has placed an order with the General Electric Co. for a 500-kw. steam turbine and instruments for a switchboard. The work is being done by the company and no contracts will be let. C. M. Einhart is superintendent.

Canada

EDMONTON, ALTA.—The city of Edmonton has entered into a contract with G. W. Farrell & Co., Montreal, Que., whereby the company will supply electricity to the city of Edmonton. The company proposes to build a hydroelectric power plant on North Saskatchewan River, 60 miles above Edmonton. The construction of an electric railway is said to be included in the plans. The cost of the project is estimated at about $6,000,000. Preliminary plans, it is understood, have been prepared by R. S. Kelsch, consulting engineer, 83 Craig Street West, Montreal.

GLACE BAY, N. S.—Plans are being prepared by A. McKinnon, town engineer, for the installation of a pumping unit, to cost from $5,000 to $10,000.

ARNPRIOR, ONT.—The Galetta El. Pwr. Co., Arnprior, is reported to be contemplating the development of a water-power on the Madawaska River.

TARA, ONT. — A by-law authorizing an expenditure of $7,500 for the installation of a hydroelectric distribution system will be submitted to the ratepayers on Jan. 3.

WESTON, ONT.—The town of Weston has decided to extend the lighting system on Beech, Rosemount and Dufferin Streets.

COOKSHIRE, QUE.—The Westbury El. Lt. & Pwr. Co., Cookshire, is reported to be contemplating extending its transmission lines to several small towns and developing another water-power on Eaton River. The cost of the proposed plant is estimated at from $25,000 to $30,000, and work may be undertaken during the coming summer.

MONTREAL, QUE.—Tenders will be received by the Board of Commissioners, City Hall, Montreal, until Jan. 4, for furnishing and erecting at the Papineau Avenue pumping station one electrically driven turbine high-lift centrifugal pump, with electric motor complete, the bidder to submit with tender the design of the pump which he intends to supply. Copies of specifications and forms of tenders may be obtained at the office of the superintending engineer of the Water Works Department. L. N. Senecal is secretary.

ST. MAURICE, QUE.—Financial arrangements, it is said, have been made by the Union Bag & Paper Co. 233 Broadway, New York, N. Y., for the disposition of its Canadian properties. These arrangements contemplate the sale of the undeveloped water-power on St. Maurice River, about 13 miles east of Three Rivers, Que., and the consolidation of the remainder of the assets of these three companies under a new company to be known as the St. Maurice Paper Co., which will be sufficiently financed to permit the erection of a new paper mill, sulphite mill and kraft pulp mill, to be situated at Cape Madeleine. Arrangements have been made with the Shawinigan Wtr. & Pwr. Co., Shawinigan Falls, for hydroelectric power sufficient for the present proposed development, and also to provide for future developments.

WARWICK, QUE.—Plans are being considered by the Town Council for the installation of an electric lighting and power system, to cost about $10,000. Negotiations

are under way with the Athabasca Wtr. & Pwr. Co., Victoriaville, to supply energy to maintain the proposed system.

MELROSE, SASK.—Improvements are being considered for the municipal electric plant (to cost about $17,000) including the installation of a 240-hp. Diesel oil engine.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing office, the Panama Canal, Washington, D. C., until Jan. 29, for furnishing one electrically driven lathe for polishing, buffing and grinding. Major F. C. Boggs is general purchasing officer.

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Jan. 4, for furnishing (under File 2165-E) 5000 ft. No. 12 B. & S. gage rubber-covered, flame-proof copper wire. Major F. C. Boggs is general purchasing officer.

PANAMA—Bids will be received at the office of the purchasing officer, Panama Canal, Washington, D. C., until Jan. 17, for furnishing galvanized sheet steel or iron, spring steel, steel and iron pipe, locomotive oilers, oil cans, lubricators, steam gages, porthole glasses, electric detonators, electrical attachments, reflectors, electric fixtures, panelboard, carbon brushes, electric wire, etc. Blanks and general information relating to this circular (No. 1000) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

Directory of Electrical Associations

Printed in the First Issue of Each Month

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AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

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AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

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CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, C. A. Littlefield, 130 East 15th St., New York.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. E. Kearns, General Electric Company, Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis. Annual convention, Hotel Wisconsin, Milwaukee, Jan. 17-19.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Executive secretary, A. Jackson Marshall, 29 West 39th St., New York. Sections in the principal electrical centers throughout the country.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Wier, Athens, Ga.

ILLINOIS ELECTRIC ASSOCIATION. Secretary, H. E. Chubbock, Peoria, Ill.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. L. Blumenthal, 179 West Washington St., Chicago, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, C. A. Littlefield, 15th St. and Irving Place, New York. Midwinter convention, New York, Feb. 10 and 11.

INDEPENDENT TELEPHONE ASSOCIATION OF AMERICA. Secretary, W. S. Vivian, 19 South LaSalle St., Chicago.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 71 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary, W. H. Thompson, Des Moines, Iowa. Annual meeting, Dubuque, Ia., May 9-12.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

JOVIAN ORDER. Jupiter (president), Thomas A. Wynne, Indianapolis, Ind.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Temporary secretary, E. A. Wright, Manhattan, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Ziegler, 227 Bourbon St., New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 14 Seventh St., N., Minneapolis, Minn.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, R. H. Smith, Jackson, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York. Annual convention, Chicago.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, New York, July 18-22, 1916.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Permanent headquarters, Room 204, Hotel LaSalle, Chicago, Ill.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M. Meeting, Albuquerque, Feb. 14-16, 1916.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, E. H. LaTourneau, 602 Electric Building, Portland, Ore.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus. Annual meeting, Cleveland, June 15 and 16.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 502 Dekum Building, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, H. N. Müller, 435 Sixth Ave., Pittsburgh, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West

Virginia Water & Electric Co., Charleston, W. Va.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg. Times Building, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, George H. Wygant, Tampa, Fla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Chas. W. Graham, Dallas, Tex.

TRI-STATE WATER & LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Blvd., Chicago, Ill. Annual meeting, Hotel Sherman, Chicago, Jan. 25-27.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

Record of Electrical Patents

Notes on United States Patents issued Dec. 21, 1915, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,164,625. IMPULSE-SENDING MECHANISM; A. H. Adams, Sparkill, N. Y. App. filed Nov. 30, 1914. Overlapping cycle type.

1,164,626. IMPULSE-TRANSMITTING MECHANISM; A. H. Adams, Sparkill, N. Y. App. filed Nov. 30, 1914. For automatic exchanges.

1,164,633. TROLLEY WIRE SUPPORT; W. F. Detwiler, Tarentum, Pa. App. filed April 29, 1915. Pivoted supporting arm.

1,164,634. ELECTRIC RIVETER; S. S. Eveland, Philadelphia, Pa. App. filed April 4, 1913. Can be used on circuits of different voltages.

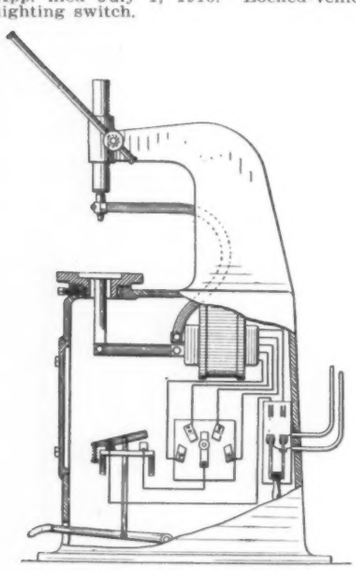
1,164,635. ELECTRIC SYSTEM OF DISTRIBUTION; G. R. Fessenden, Jr., Lancaster, N. Y. App. filed June 6, 1912. For car lighting.

1,164,662. PARTY-LINE TELEPHONE SYSTEM; G. E. Mueller, La Grange, Ill. App. filed Aug. 14, 1911. Ringing currents of different electrical character.

1,164,719. ELECTRIC MOTOR-CONTROL APPARATUS; H. F. Hitner, Mount Vernon, Ohio. App. filed Aug. 18, 1911. For drawing glass cylinders.

1,164,720. STAND-LAMP REFLECTOR; P. M. Hotchkin, Chicago, Ill. App. filed May 8, 1912. Reading lamp which illuminates room.

1,164,727. SWITCH FOR LIGHTING INSTALLATIONS; F. Kratz, Stuttgart, Germany. App. filed July 1, 1915. Locked-vehicle lighting switch.



1,164,634—Electric Riveter

1,164,728. ARC-LIGHT ELECTRODE; I. Ladoff, Cleveland, Ohio. App. filed Nov. 27, 1911. Carbon and titanate of barium.

1,164,734. ELECTROPLATING GENERATOR; D. McDermid, Irvington, N. J. App. filed July 22, 1914. Double commutator and arranged to deliver different voltages.

1,164,737. SIGNALING SYSTEM; C. F. Mead, Cleveland, Ohio. App. filed Dec. 5, 1911. For giving calls in shops.

1,164,746. SECONDARY OR STORAGE BATTERY; W. S. O'Connor, New York, N. Y. App. filed April 29, 1911. Ventilation of plates, enabling free circulation.

1,164,757. LIGHTNING ARRESTER; E. O. Schweitzer and N. J. Conrad, Chicago, Ill. App. filed March 20, 1915. Horn-gap arrester discharging under excessive pressure but not under line pressure.

1,164,767. ELECTRIC CIGAR LIGHTER; M. H. Spielman, New York, N. Y. App. filed July 26, 1915. Openings provide for current of air.

1,164,786. FIRE-ALARM BOX ATTACHMENT; A. and L. Cudosky, Passaic, N. J. App. filed May 26, 1915. Hand-cuff construction.

1,164,832. AUTOMOBILE SIGNAL; P. McLaren, Whittier, Cal. App. filed Feb. 24, 1915. For indicating intended movements.

1,164,906. AUTOMATIC CIRCUIT-BREAKER; J. P. Arndt, Neenah, Wis. App. filed June 4, 1914. Can be substituted for an ordinary fuse plug.

1,164,907. PRINTING TELEGRAPH SYSTEM; C. G. Ashley, Chicago, Ill. App. filed Feb. 6, 1911. Composite characters.

1,164,932. PLATING MACHINE; J. A. L. Deters, Chicago, Ill. App. filed Aug. 12, 1914. Articles automatically removed after thorough plating.

1,164,971. INSULATING JOINT; C. Wirt, Philadelphia, Pa. App. filed May 16, 1912. Cheap, strong construction for hickeys, etc.

1,164,984. ELECTRIC SWITCH; G. Breed, Philadelphia, Pa. App. filed March 15, 1912. Flexible blades separated by blotting paper or like compressible material.

1,164,987. METHOD OF AND APPARATUS FOR PROJECTING RÖNTGEN IMAGES; G. Bucky, Berlin, Germany. App. filed Feb. 3, 1914. Prevents injurious effect of secondary rays.

1,165,205. FITTING FOR ELECTRIC CONDUITS; J. C. Phelps, Springfield, Mass. App. filed July 8, 1914. Designed for attachment to metal molding.

1,165,038. VARIABLE-SPEED POWER TRANSMISSION; J. G. P. Thomas, Chiswick, Eng. App. filed March 1, 1913. For rail motor cars.

1,165,055. ELECTRIC FURNACE; W. J. Wrighton, Philadelphia, Pa. App. filed Feb. 19, 1915. Resistance conductor embedded in refractory material.

1,165,075. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed Nov. 5, 1910. Storage-battery charging.

1,165,098. MOTOR CONTROL; C. H. Herr, St. Louis, Mo. App. filed Jan. 30, 1915. Responsive to pressure, temperature or the like.

1,165,100. COMBINED FILLING AND GAS VALVE FOR STORAGE BATTERIES; W. E. Holland, East Orange, N. J. App. filed June 17, 1911. Plug and cover construction.

1,165,101. STORAGE BATTERY; M. R. Hutchinson and C. W. Norton, West Orange, N. J. App. filed Aug. 13, 1914. Reduced resistance.

1,165,113. ELECTRIC FUSE; T. E. Murray, Jr., Brooklyn, N. Y. App. filed May 28, 1912. Soldered joints and ends of fuse strip.

1,165,114. INSULATING PIPE COUPLING; T. E. Murray, New York, N. Y. App. filed March 25, 1915. Fits within the abutting pipe ends.

1,165,117. AUTOMOBILE SIGNAL; J. Nicholson, Sacramento, Cal. App. filed April 14, 1914. Mounted on mud guards and restored by spring motor.

1,165,126. SIGNAL DEVICE; N. E. Rennar, Jersey City, N. J. App. filed Oct. 17, 1913. Controlled from foot-brake pedal.

1,165,138. X-RAY TUBE; H. C. Snook and G. H. White, Philadelphia, Pa. App. filed April 7, 1911. Target-plug construction.

1,165,139. ELEVATOR SIGNAL SYSTEM; J. G. Somers, New York, N. Y. App. filed April 14, 1915. Signal restored when any car stops at the floor signaled from.

1,165,140. MEANS FOR PREVENTING CURRENT LEAKAGE IN ELECTRIC CABLES; S. D. Sprong and W. E. McCoy, New York, N. Y. App. filed Feb. 12, 1915. Prevents leakage at joints in cable.

1,165,141. MEANS FOR PREVENTING CURRENT LEAKAGE IN ELECTRIC CABLES; S. D. Sprong and W. E. McCoy, New York, N. Y. App. filed Feb. 12, 1915. Uses separating plates of insulating material.

1,165,164. INSULATING MATERIAL; John Ferla, New York, N. Y. App. filed May 16, 1907. Asbestos, binding cement, acetic acid and glue.

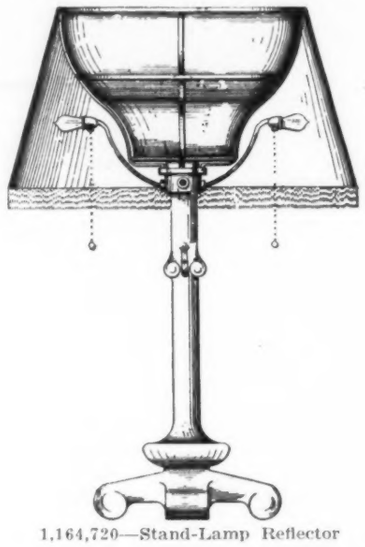
1,165,192. CIRCUIT-BREAKERS; J. W. McMillion, Mattewan, W. Va. App. filed Jan. 30, 1915. Overload type.

1,165,221. COMBINATION MAGNETO-GENERATOR; W. C. Berling, Buffalo, N. Y. App. filed Dec. 12, 1913. Designed particularly for motorcycles.

1,165,254. SAFETY CUT-OUT FOR ELECTRIC RAILWAYS; H. H. D. Heiberg, Simsbury, Conn. App. filed April 30, 1915. For single track.

1,165,255. TELEPHONE TRANSMITTER; C. D. Herrold and A. B. Portal, San José, Cal. App. filed Jan. 12, 1914. For wireless work.

1,165,273. WIRE CONNECTOR; R. H. Miller, Lansing, Mich. App. filed Sept. 4, 1914. Avoids the use of binding posts.



1,164,720—Stand-Lamp Reflector

1,165,309. GUIDE FOR TROLLEYS FOR WHEELS OF OVERHEAD TROLLEYS FOR ELECTRIC CARS; W. N. Bauer, Cincinnati, Ohio. App. filed March 13, 1914. Pivoted guide engages in groove in trolley wheel.

1,165,312. MAKE-AND-BREAK DEVICE FOR ELECTRIC CIRCUITS; J. T. Boyle, Mount Vernon, Ill. App. filed Dec. 2, 1913. For electric signs, etc.

1,165,336. MAGNETO SWITCHBOARD CORD CIRCUIT; O. M. Leich, Genoa, Ill. App. filed Oct. 19, 1914. Gives to operator a clearing-out signal and also a recall signal.

1,165,346. PLATING MACHINE; L. Schulte, Chicago, Ill. App. filed Sept. 8, 1914. Objects caused to turn over in plating barrel.

1,165,372. POTENTIAL REGULATOR; E. H. Porter, Philadelphia, Pa. App. filed Sept. 15, 1913. For alternating-current machines.

1,165,374. IGNITION DYNAMO; C. T. Mason, Sumter, S. C. App. filed July 29, 1913. Prevents excessive sparking at high speed.

14,035 (reissue). TALKING MACHINE; C. E. Woods, Bridgeport, Conn. App. filed Dec. 3, 1914. (Original patent No. 1,108,301, Aug. 25, 1914.) Tone arm free from vibration.